DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

UNDERGROUND INJECTION CONTROL (UIC) PROGRAM
QUALITY ASSURANCE MANAGEMENT PLAN

Revision 4
11/01/04

Kansas Department of Health and Environment
Division of Environment
Bureau of Water
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0 SIGNATURES/APPROVALS

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(Signature, UIC Program Manager)

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(Date)

Geology Programs Section:

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(Signature, Section Chief)

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(Date)

BOW QA Manager

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(Signature, BOW QA Manager)

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(Date)

Bureau of Water:

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(Signature, Bureau Director)

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(Date)

DOE QA Representative:

____
(Signature, DOE QA Representative)

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(Date)

Division of Environment:

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(Signature, Division Director)

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(Date)

1 INTRODUCTION

1.1 Historical Background and Overview of the UIC Program

Industrial wastes have been disposed into deep geological formation in Kansas since the 1950s and salt solution mining operations have been conducted in Kansas since the late 1800s. After several incidents nation wide where contamination was attributed to the use of injection wells, it was realized injection activities could contaminate groundwater if not conducted under strict controls. This prompted Congress to develop the Underground Injection Control (UIC) Program as a part of the Safe Drinking Water Act of 1974.

KDHE's Geology Section of the Bureau of Water (BOW) administers the state/federal UIC Program on behalf of the U.S. Environmental Protection Agency in Kansas. Underground injection is the technology of placing fluids underground, in porous formations of rocks, through wells or other similar conveyance systems. Kansas was delegated the authority to administer the Federal UIC Program on behalf of EPA in Kansas for Class I, III, IV and V wells. This delegation of authority became effective December 2, 1983. Prior to that time there was minimal regulation of industrial waste disposal wells but KDHE regulations for salt solution mining wells has been in place since 1979. The UIC Program for all classes of wells on Indian Lands in Kansas is administered by EPA. The UIC Program defines an injection well as any bored, drilled, or driven shaft or dug hole, where the depth is greater than the largest surface dimension or an improved sinkhole or a subsurface fluid distribution system, that is used to discharge fluids underground. This definition covers a wide variety of injection practices that range from technically sophisticated and highly monitored wells which direct fluids by gravity into isolated formations almost one mile beneath the earth's surface, to the far more numerous on-site drainage systems, such as septic systems, cesspools, and stormwater wells, that discharge fluids a few feet below the ground surface. While treatment technologies for these wastes exist, it would be very costly to treat and release to surface waters the vast quantities of these industrial wastes produced each year. When injection wells are properly sited, constructed, tested, monitored and operated, underground injection is an effective and environmentally safe method to dispose of waste. The Safe Drinking Water Act (SDWA) established the Underground Injection Control (UIC) Program to provide the safeguards so that injection wells do not endanger current and future underground sources of drinking water (USDW). The most accessible fresh water is stored in shallow geologic formation, called aquifers and is the most vulnerable to contamination. These aquifers feed our lakes, provide recharge for our streams and rivers, and serve as resources for a large portion of the state's population by providing water for public water supply systems. The EPA groups underground injection into five classes for regulatory control purposes. Each class includes wells with similar functions, construction and operating features so that technical requirements can be applied consistently to the class. Class I includes the emplacement of hazardous and non-hazardous fluids (industrial and municipal wastes) into isolated formations beneath the lowermost drinking water aquifer (USDW). Class I wells are the most strictly regulated and are further regulated under the Resource, Conservation, and Recovery Act if they inject hazardous waste.

Class II injection wells include injection of brines and other fluids associated with oil and gas production. Class II wells are regulated by the Kansas Corporation Commission. Class III encompasses injection and recovery of fluids associated with solution mining of minerals. Salt is the only mineral solutioned mined in Kansas using Class III wells. Class IV address injection of hazardous or radioactive waste into or above a USDW and is prohibited unless authorized under other statutes for groundwater remediation. Class V includes all underground injection activities not included in classes I through IV. Generally Class V wells inject non-hazardous fluids into or above a USDW and are typically shallow, on-site disposal systems, such as floor and sink drains which discharge directly or indirectly to the groundwater through dry wells, leach fields, and similar types of drainage wells. Injection practices or wells which are not covered by the UIC program include other residential waste disposal systems that inject only sanitary waste and commercial waste disposal systems that serve fewer than 20 persons that inject only sanitary waste. Injection wells have the potential to inject contaminants that may cause our underground sources of drinking water to become contaminated. The UIC Program prevents this contamination by setting minimum requirements. The goals of the state/federal UIC Program are to prevent contamination by keeping injected fluids within the well and the intended injection zone, or in the case of injection of fluids directly or indirectly into a USDW, to require that injected fluids not cause a public water system to violate drinking water standards or otherwise adversely affect public health. These minimum requirements affect the siting of an injection well, and the construction, operation, maintenance, monitoring, testing, and finally the closure of the well. All injection wells require authorization under general rules or specific permits. Federal UIC Program regulations can be found in 40 CFR Part 144, 40 CFR Part 145, 40 CFR Part 146, 40 CFR Part 147, and 40 CFR Part 148. State program requirements are promulgated as regulations and may be found in K.A.R. 28-43-1 et seq., and K.A.R. 28-46-1 et seq. Article 43 of the regulations addresses construction, operation, monitoring, and abandonment of salt solution mining wells. Article 46 addresses underground injection control regulations.

1.2 Quality Assurance/Control Objectives

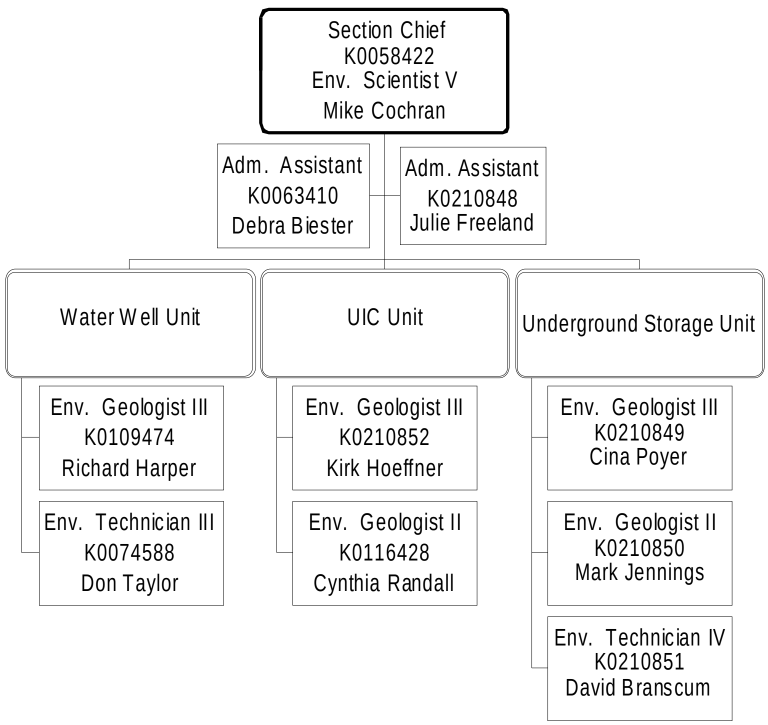
Quality assurance (QA) and quality control (QC) activities conducted within KDHE's underground injection control program are intended to ensure that all monitoring and analytical data are scientifically valid, defensible and of known and acceptable precision and accuracy. The remainder of this document describes the procedural QA/QC criteria developed to meet these objectives. Standard Operating Procedures (SOPs) and equipment are described in the appendices of this program management plan.

2 QUALITY ASSURANCE/CONTROL ORGANIZATION

2.1 Administrative Organization

The organizational framework for the Underground Injection Control Program in the Bureau of Water is depicted in figure 2.1-1 below.

Figure 2.1-1



2.2 Staff Responsibilities

The following paragraphs summarize the primary functions and responsibilities of the Geology Section and the Underground Injection Control Unit.

Geology Section - This section consists of three units: the Underground Injection Control Unit, Underground Storage Unit, and Water Well Unit.

The Underground Injection Control Unit is responsible for generally permitting and monitoring underground injection wells, excluding Class II wells. In regard to UIC Program

activities, the Underground Injection Control Unit administers the Class I, Class III, Class IV, and Class V program activities. Permitting activities typically involve detailed hydrogeologic reviews, reviews of alternative treatment and disposal methods, plans for the handling and disposal of drilling fluids and waste, evaluations regarding the compatibility of injection well components in regard to the types of wastes or extracted minerals they will come into contact with, detailed evaluations regarding compatibility of the waste with the injection zone fluids and materials, construction procedures proposed to protect groundwater aquifers, the planning and review of geophysical logs, financial assurance mechanisms for closure of the well, instrumentation and methods for monitoring mechanical integrity and operation of the wells, hydrogeologic sampling of formations and formation fluids encountered, and proposed plugging methodologies. The Underground Injection Control Unit also provides compliance monitoring oversight by both reviewing monitoring reports submitted by UIC facilities and conducting inspections of these facilities. Compliance and enforcement actions are also initiated as required. Technical assistance is provided to permittees and consulting firms providing construction or geophysical testing services to the UIC operators. The Underground Injection Control Unit also develops permits which address operational conditions and limitations under which operators of UIC injection wells are to conduct injection practices. The Underground Injection Control Unit staff is located in the central office and provides almost 100 percent of all field activities conducted in regard to UIC Program activities. Because of the nature of the wastes involved, the depths to which the wells are constructed, and the need for specialized equipment for conducting mechanical integrity tests, geophysical logging, the collection of geological core samples, and the sampling of formation fluids, KDHE staff is involved in little, if any, analytical sampling. The majority of activities conducted by the UIC program staff involve witnessing construction and plugging practices, geophysical logging, testing and reviewing data generated by the UIC facilities regarding day-to-day operation of the injection wells and any groundwater monitoring well systems employed at a facility. Provided in the appendices to this QAMP, are numerous standard operating procedures that are offered as guides to UIC operators or consultants in developing various construction, plugging or sampling plans as a part of UIC program activities. Since KDHE does not actively conduct these tests, these standard operating procedures are provided in the appendices as reference material as they are provided to permittees and consulting firms for consideration in developing their various plans which are required to be submitted, reviewed by KDHE, and approved prior to their being implemented.

3 QUALITY CONTROL CRITERIA AND PROCEDURES

3.1 Monitoring Site Selection Criteria

The selection of field monitoring sites is based on several factors including type and purpose of sample, representativeness, ability to document or relocate the sampling site, prevention of sample contamination, accessibility, and safety. Selection criteria vary depending upon the type of medium being sampled, as described in the following paragraphs.

3.1.1 Monitoring Site Selection Criteria - Underground Injection Control

Samples for compliance monitoring (grab or composite) must be collected at the point described in the UIC permit. Sample collection, preservation and handling procedures are spelled out in detail in Appendix B, I., F. in Part III of the QA/QC document.

Safety concerns related to sampling include strong acids and bases, toxic materials, toxic atmospheres, slippery floors, mechanical and electrical hazards, vehicle traffic, heavy equipment operation, and confined spaces, to name a few.

Construction, plugging, and mechanical integrity testing requirements, criteria, pass/fail criteria, witnessing procedures and reporting forms are provided in KDHE's "State Of Kansas Underground Injection Control Program Description - June 1995".

Safety hazards related to UIC witnessing procedures include strong acids and bases, toxic materials, toxic atmospheres, slippery floors, mechanical, electrical and fire hazards, vehicle traffic, heavy equipment operation, and confined spaces, to name a few.

3.2 Sampling Procedures and Sample Custody

3.2.1 UIC Samples

As indicated previously, little if any direct sampling and analysis is conducted by KDHE staff in administering the UIC Program. One exception could possibly be sample collection of groundwater from observation wells located at Class III operations. Typically because the sampling of the Class III operations requires analysis for chlorides, KDHE would primarily have the facility collect samples which KDHE may split with facility for conducting chloride analysis. Sample procedures could also conceivably involve investigations in an attempt to determine if waste not authorized by the UIC permit or hazardous wastes are being injected in violation of UIC and RCRA regulations. Any investigative work conducted in this regard would utilize sampling protocols developed by the Bureau of Waste Management in regard to RCRA sampling or wastewater sampling procedures outlined in SOP #WPCP-002.

3.2.2 Sampling Procedures and Sample Custody

Regulated entities required to sample wastes being injected as a condition of their UIC permit shall abide by the procedures set forth in their permit. Samples to be analyzed in an onsite laboratory shall be collected in an appropriate sample container, and transported immediately to the laboratory where chain of custody will be transferred to the laboratory analyst or other designated employee. Collection, preservation, storage, and analysis shall be in accordance with 40 CFR 136 and/or Appendix B, (SOP # WPCP-002). The sample collector shall log the date, time, name, and the exact location of the sample collection as per K.A.R. 28-16-63.

The sample shall be analyzed using laboratory techniques approved by EPA and the State of Kansas. The analyst shall record the dates the analyses were performed, who performed the analyses, analytical techniques/methods used, and the results of such analyses. The permittee shall maintain the records for a period of three years.

Samples to be transported to an offsite laboratory shall be preserved and iced as per 40 CFR 136.3, Table II. Custody may be retained by the sample collector and transferred to the laboratory, transferred to a transporter, or the sample may be mailed directly to the laboratory, providing holding times will not be exceeded. Ultimately, the sample chain of custody will be transferred to the laboratory in accordance with the laboratory QA/QC protocols.

3.3 Analytical Procedures

Analytical procedures to be discussed in this section are generally field laboratory tests, either performed in the field with portable test kits and reagents or in a wastewater laboratory. The analytical procedures can be grouped as titrations, gravimetric, potentiometric or colorimetric analyses. GS-UIC Program staff typically do not conduct any field laboratory tests. Samples for compliance monitoring and evidentiary samples (except for those field tests which must be done on-site) shall be collected and transported to the KDHE laboratory or an approved commercial laboratory.

Staff are expected to utilize their best professional judgement when confronted with an “out-of-control situation”. They are to report the situation to their supervisor and explain what actions they took to address the situation.

3.4 Internal Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

3.4.1 In-house Audits

During system audits, staff responsible for field operations are required to demonstrate consistent technique regarding sample collection, sample preparation, and chain-of-custody. The section chief is responsible for maintaining a log of audit results and for summarizing these results in annual QA reports to the Division QA director (see section 3.8, below).

3.4.2 Procedural Blanks, Duplicate Measurements and Spiked Samples

The possibility of sample contamination during sample preparation, storage and analysis is assessed through the use of procedural blanks, prepared with ASTM Type I-quality water and subjected to the same treatment as the rest of the samples collected as a result of the investigation or project. Under this protocol blanks are utilized in the following manner:

(a) Should the blank concentration exceed the sample concentration, a corrected concentration normally is not included in the data file; however, should the sample concentration be less than the minimum detection limit (MDL) of the analytical method, the concentration is recorded as such regardless of the blank concentration.

(b) Should the blank concentration be less than the MDL, the sample concentration is recorded without modification.

In the event a blank level exceeds the MDL, the level is not deducted from the reported sample concentration; rather, a sequence of corrective action procedures is initiated in accordance with section 3.6.

The possibility of sample contamination from sample containers is assessed through the analysis of container blanks. Five percent of the sample collection containers are selected at random, partially filled with ASTM Type I-quality water, sealed, and stored for a 48-hour interval. The resulting container blank is analyzed to determine levels of impurities leached from the container walls. If detectable concentrations of impurities are observed, a sequence of corrective action procedures is initiated.

In the case of a special monitoring program, one of the sampling sites in the network shall be equipped with two composite samplers, located side-by-side to facilitate the collection of duplicate samples. The alternative is to collect two grab samples at a selected station each time. Data generated by the duplicate sampling effort are used to assess the chemical variability of the sampling and analysis activities. In the case of a special investigation or fishkill, a duplicate sample shall be collected at one of the sampling points. These data provide a basis for quantifying the statistical uncertainty inherent in sample collection.

For UIC samples, it is important that the magnitude and variability of contamination be reduced as much as possible. For metals analyses, for instance, a blank level greater than one-half the respective sample concentration initiates corrective action. This action may include decontamination of containers used for collection and storage of the samples and related equipment. Should contamination problems persist the section chief performs an unscheduled system audit of field performance audit. If necessary the section chief works with the Kansas Health and Environmental Laboratory (KHEL) to identify any contributing sources of contamination. The scope and magnitude of any sample contamination problem, as well as all corrective action implemented to resolve the problem, are documented in the annual QA reports to the Division QA director (see section 3.8, below).

At the discretion of the Section Chief, the Bureau Director, or the Bureau QA Director, blind reference samples, spiked with known concentrations of one or more parameters, may be submitted to KHEL and used as a general indicator of the overall accuracy of the data reported by the laboratory.

3.4.3 Safety Procedures

Safety procedures for handling field sampling and laboratory equipment must be followed carefully. Safety hazards include handling strong acids, strong bases, and toxic reagents. Materials to be sampled also present safety concerns, particularly sewage with its potential for infection.

3.5 External Procedures for assessing Data Precision, Accuracy, Representativeness and Comparability

3.5.1 Onsite Audits

Bureau of Water monitoring programs may, at the discretion of the Director of the Bureau of Water, be required to participate in periodic QA/QC audits conducted by an independent third party. Audit findings, and corrective actions implemented in response to such findings, shall be reported to the Bureau Director and Bureau QA Director and addressed in detail within the annual program evaluation.

3.5.2 Interlaboratory Sample Comparison Programs

Whenever possible, samples shall be split between the permittee or other entity and KDHE and the samples sent to the respective laboratories. Comparison between laboratory results shall be reviewed by the program manager or unit chief and passed on to the section chief for inclusion in the annual QA report. Consistent finding of disparities greater than 10% shall be cause for implementation of corrective action procedures.

3.6 Corrective Action Procedures

3.6.1 Sample Contamination

The discovery of sample contamination as outlined in section 3.4.2 will lead to corrective action procedures should the contamination exceed the MDL. Possible sources of contamination could include impure sample preservative, the wrong preservative, improper handling, or improper storage, the Section Chief or Program Manager will investigate and take the necessary steps for correction. The steps taken will be recorded for inclusion in the annual QA report.

3.6.2 Staff Performance Problems

Should a member of the project or field staff have difficulty with a given work procedure (e.g. as determined during an internal performance audit) an effort is made by the Section Chief to identify the scope and seriousness of the problem, identify any data affected by the problem, and recommend an appropriate course of corrective action. All effected data are either deleted from the file or flagged within the file, at the discretion of the Section Chief. Possible corrective actions include further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

3.7 Data Management

Completed sample analysis reports from KHEL are delivered by inside mail to the Chief of the Technical Services Section, then routed to the appropriate project staff or program manager for data reduction and validation. The data are checked for conspicuous oversights or dubious results. Should problems be noted in the data reports, corrective action procedures are initiated in accordance with section 3.6.

Each analysis report is electronically filed at the laboratory; hard copies are filed in the appropriate BOW file after they are reviewed by staff. Copies of UIC monitoring reports are kept on file for a minimum of three years.

3.8 Quality Assurance Reporting Procedures

The Section Chief is responsible for informing the Bureau Director or Bureau QA Director of project QA/QC status and of any QA/QC needs within the wastewater pollution control program. They are also responsible for maintaining adequate communication with KHEL with regard to program QA/QC concerns.

In addition to these routine communication requirements, the Section Chief prepares an annual program QA/QC status report which is routed through the Bureau Director to the Division QA Director. This report contains the following types of information:

(a) status of QA project plan;

(b) description of data accuracy, precision, completeness, representativeness and comparability;

(c) discussion of significant QA/QC problems, corrective actions, progress, needs, plans and recommendations;

(d) results of internal and any external system or performance audits;

(e) summary of QA/QC-related training performed since the last QA/QC status report; and

(f) any other pertinent information specifically requested by the bureau director or the Division QA Director.

APPENDIX A

INVENTORY OF PROGRAM FIELD AND LABORATORY EQUIPMENT

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INVENTORY OF PROGRAM FIELD AND LABORATORY EQUIPMENT

I. UIC SAMPLES

A. Safety and Sampling Equipment

1. KDHE laboratory sample collection bottles for metals, nutrients, volatile organics (43 ml and 200 ml), bacteriological, organics and pesticides, inorganics cubetainers, dissolved oxygen bottles (Winkler method)
2. Cooler
3. Hard Hat
4. Safety Goggles
5. Leather Boots
6. Protective Coveralls

B. Testing Equipment

GS UIC Program staff do not utilize field testing equipment.

APPENDIX B

STANDARD OPERATING PROCEDURE

SAMPLE COLLECTION, PRESERVATION AND HANDLING

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I. SAMPLING

A. Samples for the Underground Injection Control Program shall be collected in the following manner:

1. Contact the representative of the company owning the injection well for a staff member to accompany KDHE sample collector. Offer to "split" the sample, one portion going to the company's laboratory for analysis and the other going to the KDHE laboratory.

2. The type of samples needed should be determined beforehand so that the correct containers, preservatives, coolers or ice chests, safety equipment, and sampling equipment are on hand.

3. Locate a sampling tap which will yield a sample representative of the flow normally received by the UIC well. Ideally the well should be receiving wastewater at the time of sample collection so that unrepresentative material in the pipe is not sampled. Turn the tap on so that a gentle stream is being discharged.

4. Fill the sample containers one by one by allowing water to run by gravity into the container(s).

5. Samples for inorganic analysis should be collected in collapsible, one liter polyethylene containers (Cubitainers). Samples for pesticides, base neutrals or acid extractables should be collected in one gallon brown glass containers provided by KHEL. Samples for VOC analysis should be collected in 41 ml glass vials provided by the laboratory. Fill the vial overfull so that surface tension causes the water to "heap up". Put the plastic septum on, shiny side down, so that no air bubbles are trapped and screw the cap on. Invert the container and flick it with a fingernail to make sure that no bubbles are trapped in the container. If so, repeat the sampling procedure.

6. Put all the filled sample containers in an ice chest for transfer to the laboratory.

7. Implement the chain-of-custody documentation.

APPENDIX C

STANDARD OPERATING PROCEDURE

MANAGEMENT AND REPORTING OF DATA

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I. DATA CUSTODY

The purpose of this standard operating procedure (SOP) is to establish uniform policies and procedures for maintaining an accurate written record of a sample from the time it is collected through its introduction as evidence into litigation proceedings and to insure that a sample has not been tampered with or altered throughout the process.

A. The sample by definition is in custody if:

1. It is in actual physical possession of the sample collector.

2. It is in view of the sample collector after being in the collector's physical possession

3. It is locked up after being in the sample collector's physical possession.

4. It is placed in a designated secure area.

B. FIELD PROCEDURES

1. Chain -of- Custody procedures will be followed for all tests deemed to be of importance for compliance with statutes and regulations and for those which could become evidence in litigation. Samples for plant process control, field screening analyses, or other samples collected for a technical or information purposes will not need to follow chain of custody procedures. In general, those samples submitted to the KDHE laboratory will be subject to chain of custody procedures.

2. In order to insure adequate control and documentation of collected samples, the number of personnel handling the samples should be minimized.

3. A unique number shall be assigned to each sample for identification purposes. If a sample consists of several bottles for analysis of different parameters from the same sample, the same sample number is used for each portion of the original sample.

4. If the samples are to be shipped to other laboratories for analysis a sample label is attached to each sample container at the time of collection.

5. Record all field measurements and other pertinent data on the field sheet.

6. Custody of the sample is initiated at the time of sample collection by insuring that the sample is in the sample collector's physical possession or view at all times, or is stored in a locked place where there could be no reasonable possibility of tampering. The sample collector is responsible for the collected samples until they are received by the laboratory or have been appropriately shipped to the lab. The chain of custody record is initiated at the time of sample collection and a copy accompanies the samples. The chain of custody record is at the bottom of the KDHE laboratory sheet. Signatures and dates on the sample custody sheet shall be signed in indelible ink. The sample shall make sure the name, date, time, exact location, sample identifiers and parameters for analysis are listed before signing off. The person assuming custody shall sign and date the custody section of the sheet in the sample collector's presence. An exception is samples delivered after hours; these must be placed in the designated sample storage area of the KDHE laboratory by the individual having custody.

II. DATA MANAGEMENT

Data received from the laboratory shall be forwarded to the Chief of the Technical Services Section, Bureau of Water, or a designated project manager. The data will be examined and any unusually high values or values considered to be unreasonable will be noted and brought to the attention of the laboratory and the appropriate section or unit chief. High values for a given contaminant or parameter may indicate a real problem, but occasionally occur as a result of a decimal error, a missed dilution at a permittee laboratory, sample collection at the wrong location or other error. Such errors should be corroborated and noted and initialed on the data reporting sheet prior to passing the information along or filing.

Significant figures must be checked to ascertain that no unusual degree of accuracy is implied by the result. For instance, BOD values expressed to thousandth of a milligram per liter. Report results shall be checked for comparison with the degree of accuracy expressed as the permit limits.

The laboratory results shall then be forwarded to the appropriate section or project manager. The copy distribution list shall be reviewed to make sure the information is distributed to all who need it. A copy is routed to the appropriate file and/or electronic data base.

The GS-UIC staff does not utilize ancillary data obtained from third parties.

Semi-annual/Annual reports are provided to EPA as a condition of the federal grant received to administer the UIC Program.

APPENDIX D

STANDARD OPERATING PROCEDURE

EVALUATION OF DATA QUALITY

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QUALITY CONTROL AND STATISTICAL EVALUATION OF DATA

Accuracy is a measure of how closely the analytical result or the average of a set of analytical tests approaches the true value of a parameter. Two types of error affect accuracy: systematic error and random error. An example of systematic error would be inaccuracy in a piece of laboratory equipment, for example a laboratory balance that consistently under-weighs. Random error is error from a variety of sources which cannot be totally controlled. Errors in the use of pipettes, graduated cylinders, or other laboratory equipment are examples. Random error is controlled by averaging a series of replicate analyses of a sample.

Precision measures how closely a series of replicate measurements approaches the average. It is a measure of how well results can be reproduced. A laboratory may have a high degree of precision on a given test but be inaccurate. It is necessary to control both precision and accuracy to achieve a consistency of data quality.
A number of methods are available for evaluating both accuracy and precision. However these measures do not account for errors in sampling and handling that occur prior to laboratory analysis.

A. Wastewater Laboratories

Wastewater laboratories and commercial laboratories providing effluent quality data to the Bureau for compliance purposes shall be certified by the Kansas Department of Health and Environment and shall follow the Laboratory Certification Section guidelines for data evaluation and quality.

B. Contract laboratories analyzing samples for a Bureau project must conform to the following general guidelines for data quality and evaluation:

1. At least 10% of a given number of samples should be for quality control purposes. At least one blank, one spike sample and one set of duplicates shall be analyzed with each sample set.

2. For accuracy determinations spiked samples shall be used. The use of spikes is preferable to the use of analysis of known standards as the spikes more nearly approach the true range of values encountered in analyzing the samples. The procedure involves the addition of a known quantity of standard to a known volume of unknown sample. Replicate analyses of both the known and the unknown sample are run and the results are compared to generate a percent recovery. Ideally, the result should be 100% but results between 90% and 110% are acceptable. The procedure for calculating percent recovery is as follows:

a. Determine the unknown sample concentration by averaging the results of replicate analyses.

b. Calculate the theoretical concentration of the spiked sample. (See Wastewater Sampling for Process and Quality Control, Water Environment Federation, 1979, p64.

c. Determine the spiked sample concentration by averaging the results of the duplicate analyses.

d. Divide the spiked sample concentration by the theoretical concentration. Multiply the result by 100. The result is the percent recovery.

3. For measurement of precision it is necessary to measure a series of replicate samples. The degree of precision required shall be determined at the outset of the project and incorporated onto the project QA/QC Plan. The determination of precision shall be through the use of average deviation, variance and standard deviation.

C. UIC Samples

As indicated previously, KDHE staff seldom conduct sampling at UIC facilities. The following data control procedures would apply in these cases if sampling were conducted:

1. Whenever possible these industries will be targeted for split samples. One portion of the sample will go to the industry's lab or the commercial lab used by the industry and one portion will go to the KDHE laboratory for comparison.

2. Sample values in any parameter differing by more than 10% will be cause for an extensive evaluation of the facility or commercial lab quality control procedures.

APPENDIX E

UIC STANDARD OPERATING PROCEDURES

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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

FORMATION PRESSURE FALL-OFF TEST AND TESTING PLAN DEVELOPMENT PROCEDURES

Procedure #: UICI-2

SECTION I. PURPOSE

The purpose of this test is to identify injection interval or wellbore problems and injection interval characteristics. It is the responsibility of the permittee to develop a testing procedure which will generate adequate data for a meaningful analysis.

SECTION II. REGULATORY CITATION

KDHE regulation 28-46-30, which references 40 CFR (Code of Federal Regulations) 146.13 (d) and the UIC Permit require monitoring of the pressure buildup in the injection zone at least annually, including at a minimum, shut down of the well for a time sufficient to conduct a valid observation of the pressure fall-off. This test is known as the formation pressure fall-off test.

SECTION III. SCHEDULING OF TEST

The schedule for the test must be mutually agreed upon between KDHE and the permittee so that KDHE has the opportunity to witness the test.

SECTION IV. DEVELOPING A TEST PLAN

A plan for conducting the test shall be submitted to KDHE for review and approval prior to conducting the test. Plan approval shall be obtained from KDHE prior to commencing the test. The plan shall include a proposed schedule. The test plan must address all items listed in the Sections V through VIII of this document.

SECTION V. GENERAL PREPARATION

A review of previous fall-off tests should be conducted to assist in developing a testing procedure that will provide valid test results. This will help prevent repeating any previous mistakes or errors.

A successful test involves consideration of numerous factors of which most are under control of the permittee. These include but are not limited to the following:

1. Adequate storage for the injection liquid needs to be ensured for the duration of the test.

2. Offset wells completed in the same formation as the test well should be shut-in prior to and during the test. If this cannot be accomplished then a low, constant injection rate into the offset injection wells should be maintained prior to and during the test, if feasible.

3. The condition of the well, junk in the hole, wellbore fill or wellbore damage (as measured by skin) may significantly increase the length of time the well must be shut-in to obtain valid fall-off test data. This is especially true for wells completed in low transmissivity reservoirs or which have large skin factors.

4. The location of the shut-in valve to cease flow to the well for the shut-in portion of the test must be located at or near the wellhead. Shut-in must be accomplished as instantaneously as possible to prevent erratic pressure behavior during the test.

5. In most cases the waste liquid can be used unless the waste will be corrosive to the downhole pressure gauge.

6. A surface readout downhole pressure gauge must be used. The capability to produce plots necessary to analyze the test data should be available at the well site to help insure valid test data is obtained and false test runs are quickly identified and aborted. The gauge should be configured to obtain pressure data more frequently in the early portion of the test when the rate of pressure decline is greater. Larger time increments may be used to obtain data later in the test when the rate of pressure decline is less.

SECTION VI. CONDUCTING THE FALL-OFF TEST

The following is the recommended procedure for conducting the test. Alternative procedures that will produce valid test results and which will satisfy the requirements of KDHE and the regulations will be considered by KDHE.

1. The depth to any fill in the well should be tagged and recorded.

2. The surface readout downhole pressure gauge must be located at or near the top of the injection interval, unless previous testing indicates a more appropriate location. A surface readout should be provided to allow flexibility in determining appropriate pressure measuring and recording time intervals and to ensure valid test data is generated and false testing runs can be identified and aborted.

3. The injection rate and injection liquid density for the test must be held constant prior to shut-in. The injection rate must be high enough and continuous for a period of time sufficient to produce a pressure buildup that will result in valid test data. The injection rate must result in a pressure buildup such that a semilog straight line can be determined from the Horner plot. The injection rate should be the maximum injection rate that can be feasibly maintained constant in order to maximize pressure changes in the formation and provide valid test results, but not exceeding the daily injection volume limit of the UIC Permit.

4. The injection rate and the density (chloride concentration, total dissolved solids concentration, conductivity or pH are also acceptable) of the injection fluid must be periodically measured and recorded to insure these parameters remain constant.

5. If the stabilization injection period is interrupted, for <u>any</u> reason and for <u>any</u> length of time, the stabilization injection period must be restarted.

6. The well must be shut-in at the <u>wellhead</u> or as near to the wellhead as feasible in order to minimize wellbore storage and afterflow. The shut-in must be accomplished as instantaneously as possible to prevent erratic pressure behavior during the test.

7. The fall-off portion of the test must be conducted for a length of time sufficient such that the pressure is no longer influenced by wellbore storage or skin effects and enough data points lie within the infinite acting period and the semilog straight line is well developed.

SECTION VII. EVALUATION OF THE TEST RESULTS

A licensed geologist or licensed professional engineer, licensed by the Kansas Board of Technical Professions to practice geology or engineering in Kansas and knowledgeable in the methods of pressure transient test analysis, must evaluate the test results.

The following information and evaluations must be provided with the test report:

1. A log-log plot with a derivative diagnostic plot must be used to identify flow regimes. The wellbore storage portion and infinite acting portion of the test must be identified on the plot. Type curves must be used to verify results.

2. A Horner plot must be used to calculate the kh/u product and to determine P*. An expanded Horner plot containing the entire infinite acting portion must be reproduced in order to permit a closer inspection of the semilog slope and any data fluctuations. The slope used to calculate the kh/u product and to determine P* must be drawn on both Horner plots. In addition, the wellbore storage portion and infinite acting portion of the test must be identified on both plots.

3. The "h" value (injection interval thickness) used must be agreed upon between KDHE and the permittee. For formations with characteristics such as the Arbuckle Formation, the injection interval should be considered the entire thickness of the injection formation in the area. A reliable literature value can be used if site specific data is not available.

4. The viscosity used in analyzing the test must be that of the liquid through which the pressure transient was propagating during the infinite acting portion of the test. The information used to determine the viscosity must be provided.

5. Any test that was not shut-in long enough to develop an infinite acting period, or cannot be properly analyzed for the kh/u group of parameters using the Horner method, should be rerun, using a procedure that will result in valid test results, unless other arrangements have been made with KDHE.

6. All equations used in the analysis must be provided with the appropriate parameters substituted in them.

7. Tests conducted in relatively transmissive reservoirs are more sensitive to the temperature compensation mechanism of the gauge, because the pressure buildup response evaluated is smaller. For this reason, the plot of the temperature data should be reviewed. Any temperature anomalies should be noted to determine if they correspond to pressure anomalies.

8. Explain any anomalous data responses. The analyst should investigate physical causes other than reservoir responses.

SECTION VIII. REPORT COMPONENTS

The report to KDHE must include general information and an overview of the test, present and analyze the test data, summarize the results of the test and compare the results with previous test results. The report shall be submitted to KDHE within 30 days of test completion. The report must include the following:

1. The facility name, location, well identification number and KDHE UIC Permit number of the test well.

2. A well schematic depicting current completion and location of the pressure measuring tool during the test.

3. Test well information including wellbore radius, completed interval and type of completion.

4. The distance between the test well and offset wells completed in the same injection interval and the status of the offset wells during both the injection and shut-in portion of the test. Describe the impact, if any, the offset wells had on the test.

5. Chronological listing of the daily testing activities.

6. A description of the surface readout downhole pressure gauge used including manufacturer and type, resolution, calibration certificate and the manufacturer's recommended frequency of calibration.

7. Date of test.

8. Location of the shut-in valve used to cease flow to the well for the shut-in portion of the test.

9. Time of injection period, type of injection liquid, final injection pressure and temperature.

10. Total shut-in time, final static pressure and temperature.

11. Calculations for the following; including equations used, the equations with the appropriate parameters substituted in them, description of values used in calculations and equations and references for values used:

    * Radius of test investigation.
    * Time to beginning of the infinite acting portion of the test.
    * Horner time to the beginning of the infinite acting portion.
    * Slope or slopes determined from the Horner plot.
    * The value for kh/u (transmissibility).
    * Permeability.* Skin.
    * Pressure drop due to skin.
    * Flow efficiency.
    * Flow capacity.
    * P1hr (pressure at 1hr).

12. Explanation for any pressure or temperature anomaly.

13. Description of whether system is completion or reservoir dominated and whether the system is homogeneous or heterogeneous, including an explanation of how this was determined.

14. The following graphs must be provided:

    * Cartesian plot, pressure and temperature versus time.
    * Cartesian plot of injection rate versus time.
    * Log-Log and derivative plots with the flow regions identified (must identify radial flow).
    * Semi-log Horner and expanded Horner plots with flow regions indicated (must identify radial flow), the semilog straight line drawn, P* (extrapolated pressure) and P1hr (extrapolated pressure at 1hr).

15. A comparison of permeability, Kh/u, skin, P* and fillup with the same values determined from fall-off tests previously conducted.

16. A statement that the raw test data generated by the test will be kept on file by the permittee for a period of not less than 3 years and will be made available to KDHE upon request during this time period. The raw test data need not be submitted to KDHE unless requested.

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Bureau of Water - Geology Section
1000 S.W. Jackson, Ste. 420
Topeka, Kansas 66612-1367

KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

PROCEDURE FOR CONDUCTING THE OXYGEN ACTIVATION (OA) LOG FOR EVALUATING EXTERNAL MECHANICAL INTEGRITY OF A CLASS I DISPOSAL WELL

Procedure #: UICI-3

Narrative:

The purpose of this test is to evaluate the external mechanical integrity of the well. A well has external mechanical integrity if there is no significant fluid movement behind the casing through vertical channels adjacent to the wellbore. One method of checking external mechanical integrity is by conducting the Oxygen Activation (OA) Log following the procedures listed in this document.

A plan for this test shall be submitted to KDHE for review and approval prior to conducting the test. In order to provide KDHE the opportunity to witness the test, the schedule for conducting the test shall be mutually agreed upon. Plan approval shall be obtained from KDHE before commencing the test. The plan shall include a prognosis and schedule for conducting the test. The procedure listed is general in nature. When developing a test plan for an individual well the well configuration, hydrogeology, and operating conditions must be considered. K.A.R. 28-46-33 establishes mechanical integrity requirements. Unlike other approved tests that are subject to interpretational opinion, the OA log provides a more direct method of determining external mechanical integrity.

Modification of this procedure will be considered providing it is demonstrated there is good cause and the objective of this procedure will be achieved.

Procedure:

1. Clear the wellbore of any material that would be corrosive to the logging tools and ensure that there are no obstructions in the well that will prevent passage of the tools.

2. Conduct a baseline Gamma Ray Log and casing collar locator log from the top of the injection zone to the surface prior to taking the stationary readings with the OA tool. This is necessary to evaluate the contribution of naturally occurring background radiation to the total gamma radiation count detected by the OA tool. There are different types of natural radiation emitted from various geologic formations or zones and the natural radiation may change over time.

3. The OA log shall be used only for casing diameters of greater than 1-11/16 inches and less than 13-3/8 inches.

4. All stationary readings should be taken with the well injecting fluid at the normal rate with minimal rate and pressure fluctuations.

5. Prior to taking the stationary readings, the OA tool must be properly calibrated in a "no vertical flow behind the casing" section of the well to ensure accurate, repeatable tool response and for measuring background counts.

6. Take, at a minimum, a 15 minute stationary reading adjacent to the confining interval located immediately above the injection interval. This must be at least 10 feet above the injection interval so that turbulence does not affect the readings.

7. Take, at a minimum, a 15 minute stationary reading at a location approximately midway between the base of the lowest most usable water zone and the confining interval located immediately above the injection interval.

8. Take, at a minimum, a 15 minute stationary reading adjacent to the top of the confining zone.

9. Take, at a minimum, a 15 minute stationary reading at the base of the lowermost usable water zone.

10. If flow is indicated by the OA log at a location, move uphole or downhole as necessary at no more than 50 foot intervals and take stationary readings to determine the area of fluid migration.

11. The results of the OA log and an interpretation of the log by a person with the technical expertise to evaluate the log shall be submitted to KDHE within 30 days of the test completion. Intervals where flow is indicated shall be described and the significance discussed.

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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

PROCEDURE FOR CONDUCTING A SONAR SURVEY ON A SALT SOLUTION MINING WELL (CLASS III WELL)

Procedure #: UICIII-5

Narrative:

K.A.R. 28-43-7(d) states when calculations based upon a model theory approved by KDHE indicate that fifty (50) percent of the useful life of a well has been reached, the well or system shall be checked by the operator to determine the dimensions of the cavern developed by the solutioning and thereafter upon increments of each ten (10) percent of useful well life. This frequency is a minimum. Sonar frequency may be more stringent per permit requirements. A sonar survey approved by KDHE shall be used for this purpose. KDHE will also require a sonar when the dimension or configuration of the cavity would have a bearing on continued stability or if other problems are indicated. The schedule for the sonar shall be mutually agreed upon so KDHE may have the opportunity to witness the sonar. The sonar shall not be conducted until plan and schedule approval has been obtained from KDHE. The following procedure for developing a sonar plan and conducting a sonar will assist in ensuring an acceptable determination of the dimensions and configuration of the cavity is achieved. It is the operator's responsibility to conduct a sonar survey that satisfies the requirements of K.A.R. 28-43-7(d) and KDHE.

Procedure:

1. List the well identification number and location of the well to be sonared.

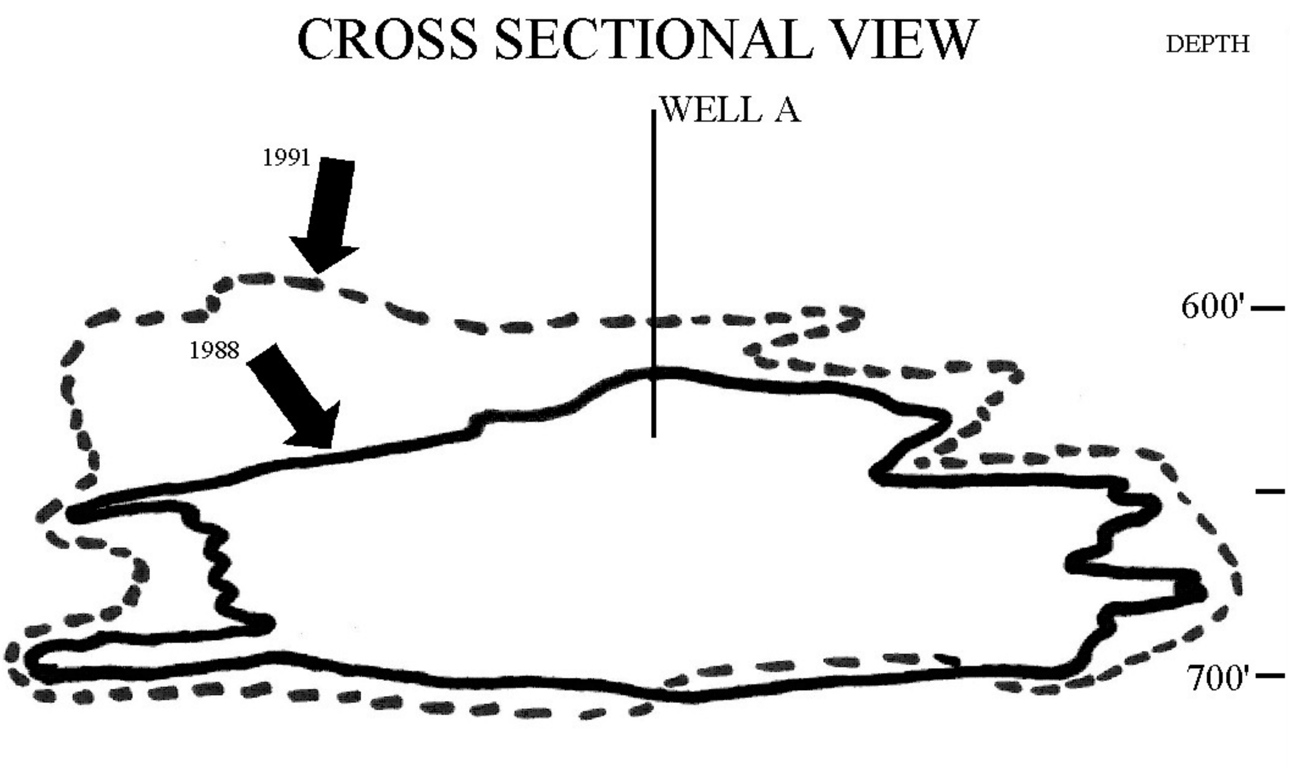
2. The sonar must be conducted in the cavity with the tubing removed from the cavity.

3. Provide a schematic of the well configuration at the time the sonar will be conducted including salt top, cavity top and casing seat.

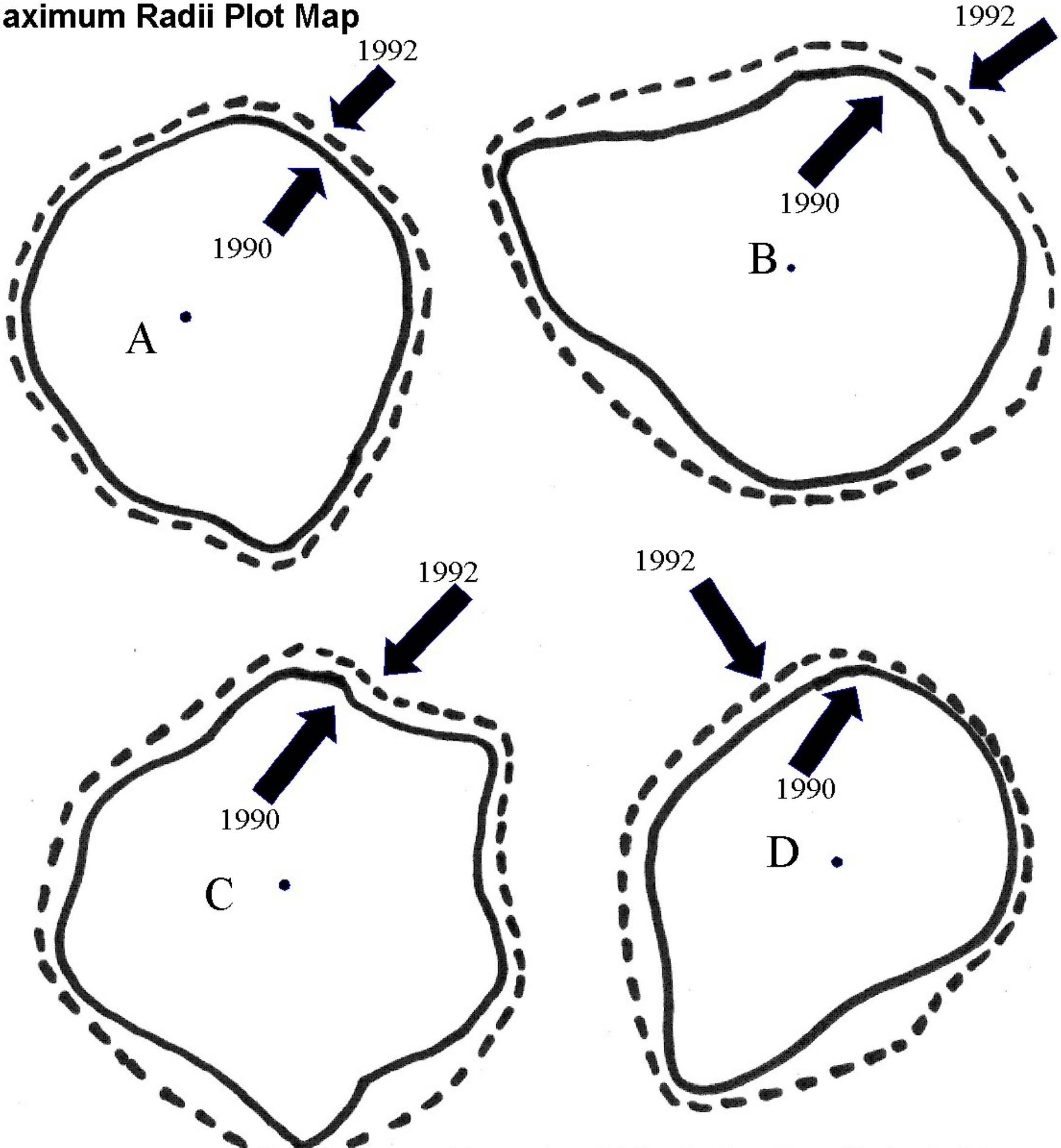
4. Describe the action that will be taken if the sonar tool will not pass through the well and/or cavity.

5. The sonar survey results and interpretation shall be submitted to KDHE within 30 days of completing the survey. The interpretation must be made by a person with the technical expertise and knowledge to evaluate the sonar survey results. The interpretation should include a discussion of the dimensions and configuration of the cavity, the relationship of the cavity to adjacent cavities, a description and explanation of any anomalies, a description of those parts of the cavity blocked from view by fallen shale layers and a description of any changes in operation necessary to obtain desirable cavity dimensions and configuration. An updated diagram depicting the maximum cavity radii for the well sonared in relation to the maximum cavity radii for nearby wells shall be provided. Maximum radii information from any previous sonar surveys shall also be included on the diagram to provide a graphic display of the cavity growth and development over time. An example of an acceptable diagram is attached. Cross-sectional views should also include a comparison to previous sonar results. An example of an acceptable cross-section is attached.

   If the sonar and interpretation cannot be submitted to KDHE within the 30 day time period, the permittee must then request in writing a time extension from KDHE. The request must include both an explanation of why the extension is needed and a proposed schedule for submitting the sonar results and interpretation to KDHE. The request will be reviewed by KDHE to determine if approval can be granted.



Maximum Radii Plot Map



Map should include all wells in field

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Topeka, KS 66612-1367

KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

PROCEDURE FOR THE PRESSURE MECHANICAL INTEGRITY TEST OF A CLASS III SALT SOLUTION MINING WELL

Procedure #: UICIII-6

Narrative:

The purpose of this test is to evaluate the internal mechanical integrity of the well. A well has internal mechanical integrity if there is no significant leak in the casing. Internal mechanical integrity is checked by conducting a hydraulic pressure test of the casing and monitoring for a pressure loss. The test shall be witnessed by a representative of KDHE, therefore the schedule for the test shall be mutually agreed upon.

A plan for this test shall be submitted to KDHE for review and approval prior to conducting the test. Include a diagram of the surface and subsurface well completion. The plan shall include a prognosis and schedule for conducting the test. Plan approval shall be obtained from KDHE before commencing the test. K.A.R. 28-46-33 establishes the mechanical integrity testing requirements.

Procedure:

1. Depressure the well.

2. Pull any tubing strings from the well.

3. Set a retrievable bridge plug or packer immediately above the cavity for the purpose of pressure testing the casing. The setting depth shall have the approval of KDHE. Integrity must be demonstrated at least to a depth equal to the top of the salt. Provide information describing the packer or plug and the suitability of the packer or plug for use in this pressure test. The packer or plug must be capable of making a tight seal to allow the casing to be hydraulically pressure tested.

4. Hydraulically pressure test the casing. The liquid pressure placed on the casing is to be monitored for the purpose of determining integrity of the casing. It shall be demonstrated to the KDHE representative that the casing is liquid filled. This can be demonstrated to the KDHE representative upon completion of the test.

5. The well must be in thermal equilibrium before commencing the test.

6. Once the casing has been pressurized, vent as much of the air as possible from the well. Repressure as necessary. Once the casing has been pressurized for the test, the casing shall be isolated from all external artificial pressure sources capable of introducing pressure to the casing.

7. The minimum wellhead casing test pressure shall be 150 psi or 1.5 times the average maximum operating injection pressure at the wellhead, whichever is greater.

8. A description of the pressure gauge to be used to monitor the test pressure must be provided. The gauge must have a scale such that the test pressure is 40%-60% of full scale. The scale shall measure pressure in increments of no more than 2 psi per division. The gauge shall be tested for accuracy for the mechanical integrity test. A document with a description of the test, the test date, amount of error found on the gauge during the test and a description of corrective action such as recalibration shall be provided to the KDHE representative at the time of the mechanical integrity test. It shall be demonstrated the gauge is functioning properly.

9. The test shall be a minimum one (1) hour in duration.

10. The test shall be witnessed by KDHE.

11. A pressure loss of equal to or less than 5% of the initial test pressure is a satisfactory test and indicates the well has internal mechanical integrity at the time of the test. A pressure increase of greater than 5% of the initial test pressure is not acceptable and may indicate the well has not reached thermal equilibrium.

12. If a satisfactory test is not obtained the well shall remain out of service until corrective action approved by KDHE has been taken and a satisfactory mechanical integrity test conducted. The location of the leakage must be determined and the impact to the environment evaluated. An environmental remediation plan and implementation schedule and a plan for repair of the well may be required to be submitted to KDHE for review and approval. No work shall commence until plan approval has been obtained from KDHE.

Failure to follow the KDHE approved MIT plan may result in cancellation of the test and shut-in of the well until the MIT is rescheduled and conducted to the satisfaction of KDHE.

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Procedure.UICIII-6
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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

PROCEDURE FOR CONDUCTING THE TEMPERATURE LOG FOR EVALUATING EXTERNAL MECHANICAL INTEGRITY OF A CLASS I WASTE DISPOSAL WELL

Procedure #: UICI-9

Narrative:

The purpose of this test is to evaluate the external mechanical integrity of the well. A well has external mechanical integrity if there is no fluid movement behind the casing through vertical channels adjacent to the wellbore. One method of checking external mechanical integrity is to conduct a series of temperature logs following the procedures listed in this document.

A plan for this test shall be submitted to KDHE for review and approval prior to conducting the test. In order to provide KDHE opportunity to witness the test, the schedule for conducting the test shall be mutually agreed upon. Plan approval shall be obtained from KDHE before commencing the test. The plan shall include a schematic of the well configuration for the test, a prognosis and a schedule for conducting the test. The procedure listed is general in nature. When developing a test procedure for an individual well; the well configuration, geology, hydrology, and operating conditions must be considered. K.A.R. 28-46-33 establishes mechanical integrity requirements.

Procedure:

1. Clear the wellbore of any material that would be corrosive to the logging tools and ensure that there are no obstructions that will prevent the passage of the temperature tool.

2. The temperature log must be conducted through the injection tubing to obtain “real condition” data and to be protective of human health and the environment.

An appropriate scale for the temperature log must be selected. Frequent shifts in the log will be required if the scale selected is too small which makes the log difficult to interpret. If the scale is too large, the log is again difficult to interpret because temperature changes and gradients are difficult to discern. A scale range of 4°F/inch to 10°F/inch is generally the best.

3. The temperature log shall be conducted in tandem with a collar locator log and a gamma-ray log. A differential temperature curve shall be included.

4. The temperature tool shall be sensitive to temperature changes of at least 0.1°F.

5. The temperature log shall be run going into the well. The logging speed should be between 20-35 feet per minute. The logging speed shall be kept constant for all sequential passes. Stopping the tool during a log run should be avoided.

6. The well shall be shut-in for a minimum of 24 hours to allow the well to reach "static" conditions prior to running the base log.

7. Record the beginning and ending clock time on each log pass.

8. Run the base log from surface to total depth after the 24-hour shut-in period.

9. Record the temperature of the liquid to be injected just prior to injection and then periodically during injection, record the temperature of the liquid injected. Provide this information with the final report.

10. Inject the greater of either three well volumes or one barrel of fluid per each foot of disposal interval. The well volume is to be calculated using the volume of the longstring casing plus the open hole interval, if applicable. The best results are obtained when the difference between the injected fluid temperature and the wellbore temperature at the zone of interest is at least 35° F, especially if the temperature log is conducted through the tubing. In no case shall the temperature difference be less than 10°F. Even minor variations in the temperature of the injection water can adversely influence the results; thus, a source of water with a uniform temperature should be used. The injection rate used should be at a normal operational injection rate and, if feasible, the maximum permitted injection rate.

11. Cease injection and place the logging tool at a depth 300 feet above the disposal zone. Make three passes from 300 feet above the disposal zone to total depth at the one-hour, two-hour and the four-hour interval after stopping injection.

12. Pull the temperature log to surface. Run the final base temperature log from surface to total depth.

13. Submit the temperature logs to KDHE with the following information on each log:

    a. time log was run
    b. well conditions, shut-in, injecting
    c. scales
    d. logging speed
    e. depth and size of various casings, depth and size of tubing, packer seat depth

    A report shall accompany the logs describing the procedure, volume of fluid injected, well construction data, rate at which fluid was injected, and the injection pressure. The report shall also include an interpretation of the logs and a description of the temperature log results by a person with the technical expertise to evaluate the logs.

14. If the well is determined to be lacking external mechanical integrity, injection shall cease immediately and the permittee shall submit the following to KDHE for review and approval: 1) an evaluation of the impact to the environment which may require additional testing approved by KDHE, 2) an environmental remediation plan and implementation schedule, and 3) a repair plan and implementation schedule for the well. No work is to commence until plan and schedule approval has been obtained from KDHE.

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Procedure.UICI-9
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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

RECOMMENDED GROUNDWATER OBSERVATION WELL SAMPLING PROTOCOL FOR CHLORIDE AND OTHER MINERAL CONSTITUENTS AT A SALT SOLUTION MINING FACILITY

Narrative:

The importance of properly sampling a groundwater observation well cannot be overemphasized. Consistent sampling procedures must be followed to ensure that the sample taken from the well is representative of the groundwater at that location. The quality of the water within the casing and in close proximity to the well in most cases is not representative of the overall groundwater quality at that sampling site. In order to collect a representative groundwater sample, it is very important that a well be purged by pumping or bailing until it is thoroughly flushed of stagnant water and contains new water from the aquifer when sampled.

Recommended Protocol:

1. Check static fluid level and the depth in the well to calculate the total volume of water in the well. On the back is a table indicating various well diameter with respective gallons per foot volumes. If the well has sufficient water production, pump or bail three (3) volumes of water from the well and then collect the water sample. If the well does not produce enough water to purge three volumes, then pump or bail the well dry and collect a sample after the well has recovered sufficiently for sampling, preferably within 24 hours after pumping or bailing dry.

2. Rinse the sampling equipment with uncontaminated water before each sample is collected in order to help prevent cross-contamination.

3. The water purged from a groundwater observation well with a chloride concentration equal to or greater than 500 ppm chloride shall be collected in a tank and returned to KDHE approved brine storage pond, disposed into a KDHE approved Class I injection well, or used as make-up water in the salt solution mining or storage well operation.

4. The water sample must be analyzed by a laboratory certified by KDHE to conduct analysis for the constituent(s) of interest.

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03/00

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KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

TABLE FOR CALCULATING MONITOR WELL VOLUME

CASING SIZE NOMINAL DIAMETER (INCHES)	GALLONS OF WATER PER ONE FOOT OF CASING SIZE (GAL/FT/CASING SIZE)
1.25	0.06
1.50	0.09
2	0.16
2.5	0.25
3	0.37
3.5	0.50
4	0.65
5	1.02
6	1.50
8	2.60
10	4.08
12	5.87
14	8.00
16	10.44
18	13.21
24	23.50
30	36.70

FORMULA TO FIND HEIGHT OF WATER COLUMN: (Total depth of water well) - (Measured static water level) = (Height of water column).

WATER VOLUME IN WELL: (Height of water column) x (Gallons/one foot of casing size) = Water volume in well.

db
03/00
c:/uic protocols/monitor well volume

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT
CLASS V UNDERGROUND INJECTION CONTROL
INDUSTRIAL WASTE DISPOSAL WELL
SAMPLING AND CLOSURE PROCEDURES

I. Introduction

A shallow Class V injection well generally emplaces nonhazardous fluids into or above the fresh or usable water zones. **There are many types of shallow Class V injection wells, including industrial waste disposal wells. This type of Class V well is the subject of this document.**

Shallow Class V injection wells such as a septic system, leachfield, cesspool, seepage pit, drywell or a well receiving or having the potential to receive industrial waste have a significant potential to contaminate the soil, groundwater and surface waters. Approximately 90% of the water used in Kansas is supplied by groundwater. Industrial wastes can contain any number of harmful, harzardous, or toxic chemicals or constituents. Cases of groundwater or soil contamination in Kansas and across the nation resulting from the disposal of industrial wastes into shallow Class V injection wells have been documented. **Based upon documented incidents of contamination resulting from the disposal of industrial waste into shallow Class V injection wells and the authority granted to the Kansas Department of Health and Environment (KDHE) by K.S.A. 65-17d and K.A.R. 28-46-27, KDHE has determined that to protect human health and the environment, industrial waste shall not be directed to a shallow Class V injection well.**

This document addresses procedures for sampling Class V Industrial Waste Disposal wells to determine if there is contamination and for properly closing these wells.

To determine which parts of this document are applicable the Kansas Department of Health and Environment (KDHE) will evaluate the Class V injection well facilities using the criteria of: type of wastes generated, past and present activities, facility operating records, KDHE interviews of facility personnel and the result of KDHE inspections.

KDHE/Bureau of Water (BOW) will coordinate with other KDHE Bureaus as appropriate for assistance with obtaining compliance, reviewing plans, conduction inspections, collecting samples and witnessing of samples and closure activities.

This document does not apply to **hazardous** waste directed to a Class V wells. The well in such a situation is actually a Class IV well. **Class IV wells are prohibited by K.A.R. 28-46-4.** If the waste directed to the well is hazardous, then the facility is subject to requirements of the Resource Conservation and Recovery Act (RCRA). Sampling, remediation and closure of Class

IV wells must be coordinated with the KDHE Bureau of Waste Management (BWM). The contact telephone number for BWM is 785/296-1600.

II. DEFINITIONS

Listed below are definitions of key terms used in this document.

well – any device used to emplace fluid into the subsurface. This included, but is not limited to, a) a bored, drilled or driven shaft, b) a dug hole whose depth is greater than the largest surface dimensions, c) improved sinkholes, or d) an infiltration system including, but not limited to, an injection gallery or septic system.

injection – the subsurface emplacement of fluids through a well.

injection well – a well into which fluid is, was, or could be emplaced below the land surface.

s**hallow Class V injection well –** an injection well that generally injects nonharardous fluids into or above the fresh or usable water zones. KDHE does not allow the injection of industrial waste into a Class V well.

Class IV injection well – an injection well that injects harzardous or radioactive wastes into or above an underground source of drinking water. These wells are prohibited by KDHE regulation K.A.R. 28-46-4.

fluid – any material that flows or moves whether it is semi-solid, liquid, sludge or gas.

septic system – an injection well that is used to emplace waste below the land surface and is comprised of a septic tank and fluid distributions systems, such as a leachfield or seepage pit.

leachfield – a fluid distribution system generally constructed of a perforated or slotted length of piping or drain tile placed in a trench and surrounded by aggregate, designed to distribute fluids evenly in the subsurface.

injection gallery – an injection well commonly comprised of one or more trenches that are backfilled with a permeable material such as gravel and designed to accept and distribute fluids through pipe laid in the trench.

cesspool – an injection well which receives waste through pipes, and which has an open bottom and sometimes perforated sides.

seepage pit – an injection well which receives waste through pipes, and which has an open an open bottom and sometimes perforated sides and is used in conjunction with a septic tank.

drywell – an injection well completed above the water table which has either no casing or simple casing, which generally constructed of either slotted standard precast concrete rings, blocks, or earthen sides, having an open bottom, designed to accept and distribute fluids to the subsurface by gravity flow through slots and openings in the sides and bottom.

sanitary (domestic) waste – waste originating primarily from kitchen, bathroom, and laundry sources, including waste from food preparation, dishwashing, garbage grinding, toilets, baths, showers and sinks.

industrial waste – wastes other than sanitary wastes generated by industrial or commercial processes.

III. INTIAL ACTION TO BE TAKEN BY CLASS V WELL OWNER/OPERATOR

The following initial actions need to be taken by the owner/operator of a Class V industrial waste disposal well:

1. **Contact the KDHE Bureau of Water (BOW) at 785/296-1843, 785/296-5554 or 785/296-5560**. Depending upon the kind of waste directed to the Class V well, the facility may be required to immediately cease directing industrial waste to the Class V well. Sanitary wastes may continue to be directed to a septic system unless notified otherwise by KDHE. Approval from the local health or environmental agency having jurisdiction must also be obtained. Directing most kinds of industrial waste to a Class V injection well is not allowed per K.A.R. 28-46-27.

2. The well is required to be inventoried by KDHE regulation K.A.R. 28-46-38. This can be accomplished by completing and submitting the attached inventory form to **KDHE/BOW, 1000 SW Jackson., Suite 420, Topeka, KS 66612-1367.**

3. Direct the wastes to an above ground holding tank for transport to a publicly owned treatment plant, if approved by the municipality, or connect directly to the municipal sewer system upon approval by the municipality. Other options might include use of recycle systems or artificially lined evaporative ponds. These options may also require a permit from KDHE. In addition, pollution prevention techniques such as reducing, recycling or reusing wastes should also be implemented to limit the amount of waste that needs to be disposed. KDHE can be contacted at 785/296-6603 for technical assistance on pollution prevention.

4. Permanently plug with concrete or other material approved by KDHE the drain(s) and any associated sumps or connection(s) to the Class V well that received or had the potential to receive industrial wastes. This includes any floor drain that has potential to receive industrial waste.

5. Sampling of the Class V well, soil or groundwater may be required by KDHE to determine if there is contamination. Any sampling required must be done in accordance with Section

CI-SAMPLING REQUIREMENTS. If the sampling results indicate there is contamination, then further action may be required by KDHE as described in Section VIII-FURTHER ACTION REQUIRED.

IV. LABORATORY ANALYTICAL REQUIREMENTS

The following methods for laboratory analyses of soil and groundwater samples must be consistent with the compounds of concern. All analyses must be conducted by a KDHE certified laboratory using KDHE or EPA approved laboratory methods.

V. CLASS V WELL SAMPLING WORK PLAN

A work plan for sampling the shallow Class V well for the presence of contaminants must be submitted to KDHE/BOW for review and approval prior to conducting any sampling activities. KDHE/BOW will coordinate review of the plan with other Bureaus as appropriate. **KDHE may request to be present during sampling and may require split samples.** The work plan must include the following items:

1. A brief history of the site describing activities conducted at the site currently and in the past.

2. Material Safety Data Sheets (MSDS) for any chemicals or materials, other than sanitary waste, that were directed, are directed or have the potential to be directed to the septic tank.

3. A plat depicting the injection system including the location of the drains that receive, received or have the potential to receive industrial waste; the location of the drain lines and the location of the septic tank, leachfield, drywell, cesspool, seepage pit, or well that received, receives or has the potential receive industrial waste. Include a discussion of how the injection system was operated and describe the waste streams directed to the injection system.

4. A copy taken from a 7.5 minute topographical quadrangle map that depicts the site location with the site location identified on the map.

5. A detailed discussion, including diagrams, describing the proposed sampling strategy developed in accordance with the guidelines listed in Section VI-SAMPLING REQUIREMENTS. In general, samples should not be composited prior to analysis. The objective is not to determine average concentrations of contaminants but to document the extent of any contamination.

6. A description of the proposed laboratory analytical program for soil and water samples including the specific analytical methodologies to be used. Include a description of proposed sampling procedures and the quality control/quality assurance procedures to be employed. The samples must be analyzed for any constituents expected to be found and as required by KDHE. Identify the laboratory that will be conducting the analyses.

KDHE or EPA approved analytical methods and KDHE approved standard operating procedures for Decontamination of Equipment, Collection of Soil Samples for Laboratory Analysis, Collection of Sediment (Sludge) Samples, Collection of Groundwater Samples at Known or Suspected Groundwater Contamination Sites, Geoprobe Operations and Mobile Laboratory Analysis, Chain of Custody and Collection of Quality Control Measures for Water-Quality Data Samples are found at Attachments I, II, III, IV, V, VI, and XIII respectively. These attachments must be considered in developing the sampling workplan.

7. A description of investigative derived waste (soil and water) handling, characterization, and disposal procedures. Attachment VII-Characterization and Disposal of Investigative Derived Wastes, should be taken into consideration in addressing this item.

8. A schedule for the sample collection.

9. Documentation harzardous waste has not been directed to the Class V well.

VI. SAMPLING REQUIREMENTS

The following are the minimum sampling requirements of the KDHE UIC Program necessary to determine if there is contamination. However, the Class V well owner/operator is responsible for adequately assessing the extent of any soil or groundwater contamination. Sampling requirements for various Class V well design are as follows:

A. SEPTIC TANK

- ❖ Collect representative samples of the liquid and sludge contained in the septic tank as depicted on attached Figures A-1 and A-2 and analyze the samples for all constituents listed in the KDHE approved well sampling work plan.

B. Leachfield

- ❖ Collect representative samples of the soils in the leachfield as depicted in attached in Figures B-1 and B-2. Collect soil samples from along side of the leachfield as in Figures B-1 and B-2 at depths of 1’ and 5’ below the leachfield lines. If these samples have contamination at levels that exceed concentrations determined acceptable by KDHE, additional sampling depths may be required. If groundwater is encountered during this process the soil sampling shall cease and a representative sample of the groundwater shall be collected. Sampling locations for different layouts or if the leachfield lines cannot be located must have the approval of KDHE/BOW. Analyze the samples for all of the constituents listed in the KDHE approved well sampling workplan.

C. DRYWELL/CESSPOOL/SEEPAGE PIT/WELL

- ❖ Collect representative samples of the liquid and sludge contained in the drywell, cesspool, seepage pit, or well as depicted in Figures B-1 and B-2 and collect representative samples of the soil from the center of the bottom of the well as depicted in Figures B-1 and B-2. If groundwater is encountered during this process soil sampling shall cease and a sample of the groundwater shall be collected. If taking sample from the bottom of the Class V well is not feasible the samples can be taken on opposite sides of the well, at a distance not to exceed one foot away from the borehole, starting at a depth that is equivalent to the depth of the bottom of the well. Analyze all of the samples for the constituents listed in the KDHE approved workplan.

VII. SAMPLING VERIFCATION REPORT

A sampling verification report documenting sampling activities in detail must be provided to KDHE/BOW. The report must be adequately detailed to allow KDHE to determine if sampling activities, sampling location selection, and laboratory analyses were conducted in accordance with the approved sampling plan. The report must include the analytical results for the samples and must summarize and discuss the results of all sampling activities.

VII. FURTHER ACTION REQUIRED

KDHE/BOW will evaluate the results of the sampling in accordance with appropriate federal and state guidelines. KDHE/Bureau of Environmental Remediation (BER) will be notified if KDHE/BOW determines that potential contamination of the groundwater and/or soil has or may have occurred. KDHE/BER will then evaluate the information to determine potential impacts to human health and the environment from the identified contamination. Further action may be required by KDHE/BER to address the contamination through additional investigation and/or remediation. If further action is required the potentially responsible party will be requested to sign an Agreement with KDHE, which will establish guidelines and objectives for the additional work. The contact telephone number for BER is 785/296/1673

IX. CLOSURE REQUIREMENTS

When the required sampling has been completed and the Class V well is no longer needed for further contamination investigation or remediation activities, the Class V well must be closed in a manner to prevent contamination of the soil, groundwater or surface water and to prevent use of the well for the disposal of industrial waste.

A closure plan must be submitted to KDHE for review and approval, including the disposal of any waste, sludge, wastewater, cleanup wastewater or contaminated soil. No closure work shall commence until plan approval has been obtained from KDHE. The closure must also comply with any local requirements.

A septic system may remain operational and continue to receive sanitary waste only id approval is obtained both from KDHE and the local health or environmental agency having jurisdiction.

The minimum closure requirements for various Class V well designs are as follows. The closure must also comply with any requirements of the local health or environmental agency having jurisdiction. An excellent source of information for plugging a septic tank is the K-State Water Quality Series brochure entitled *Plugging Cisterns, Cesspools, Septic Tanks and Other Holes,* which can be found at Attachment X. An option is to remove the tank, backfill the excavation with a clean material approved by KDHE and dispose of the removed tank in a manner approved by KDHE. If the tank is removed, then only items number 1, 2, 6 and 7 listed below apply.

SEPTIC TANK

1. Remove the contents of the tank and dispose of in a manner approved by KDHE.

2. Depending on the nature of the wastes, the tank may need to be power washed and the washwater removed and disposed in a manner approved by KDHE.

3. Remove the top of the tank

4. Puncture the floor of the tank to prevent accumulation of water in the tank.

5. Fill tank with a clean inert material such as sand, cement or other material approved by KDHE.

6. Properly level the ground surface above the tank, or the backfilled excavation if the tank has been removed, to prevent surface water ponding.

7. The floor drains and any associated sump or other drains that received or had the potential to receive industrial waste should be power washed and the washwater removed. The drain and any associated sump shall then be plugged with cement or by other means approved by KDHE.

LEACHFIELD

❖ Leachfield closure, if determined necessary by KDHE, will be required to be conducted in conjunction with any remediation activity required in Section VIII-FURTHER ACTION REQUIRED.

DRYWELL/CESSPOOL/SEEPAGE PIT/WELL

1. Remove and dispose of in a manner approved by KDHE the contents of the drywell, cesspool, seepage pit or well.

2. If praticable, remove any casing or lining material.

3. Fill the drywell, cesspool, seepage it or well with cement or other material approved by KDHE

X. ALTERNATIVES TO KDHE'S MINIMUM REUIREMENTS

KDHE will consider alternatives, which meet the intent of the KDHE minimum requirements. Alternatives shall be shall be described in detail and submitted in writing to KDHE/BOW. KDHE approval must be obtained prior to implementation.

XI. CLOSURE REPORT

Submit to KDHE/BOW upon completion of closure activities a report describing the closure, including the following items:

- ❖ Facility name, address and location
- ❖ Copies of manifests or other paperwork documenting proper disposal of all liquid, sludge and soil.
- ❖ A decription of all closure work done and dates when completed.

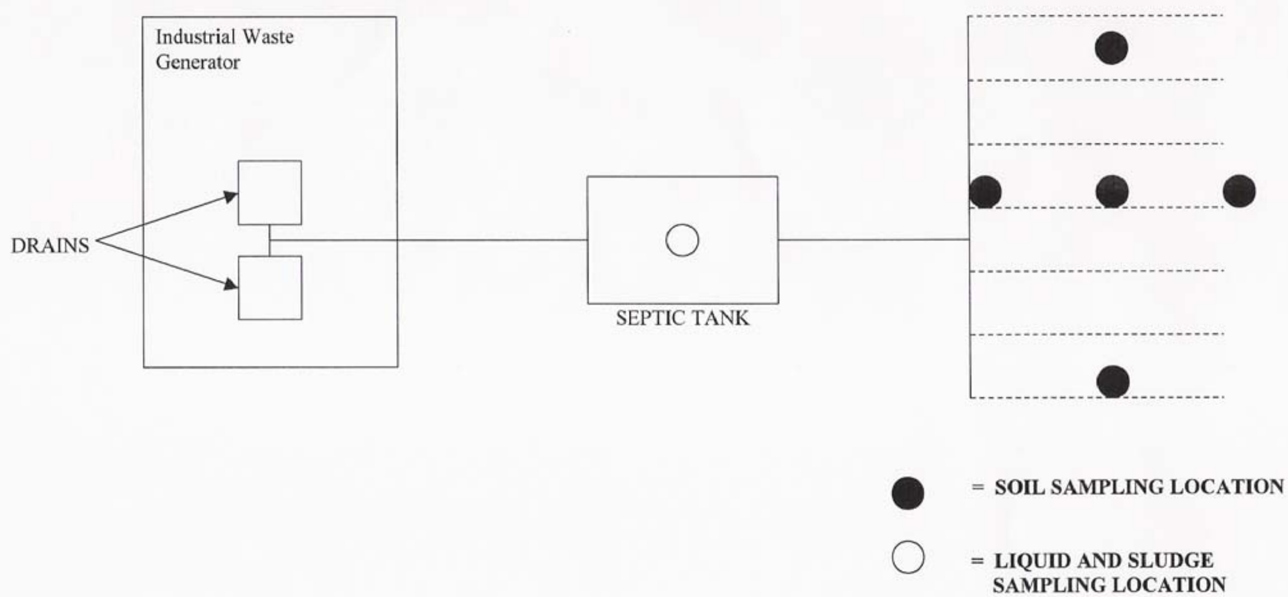
XII. REFERENCES

Reference material used in developing this document are as follows:

- ❖ EPA Region 9 guidelines for Closure of Shallow Disposal Wells, 1992.
- ❖ KDHE Underground Injection Control Regulations, Article 46.
- ❖ Report to Congress: Class V Injection Wells Current Inventory; Effects on Ground Water, Technical Recommendations; EPA Headquarters, September 1987.
- ❖ KDHE/BER Pond Closure Guidance, 1995.
- ❖ K-State water Quality Series; Plugging Cisterns, Cesspools, Septic Tanks and Other Holes 1997.

FIGURE A-1: PLAN VIEW

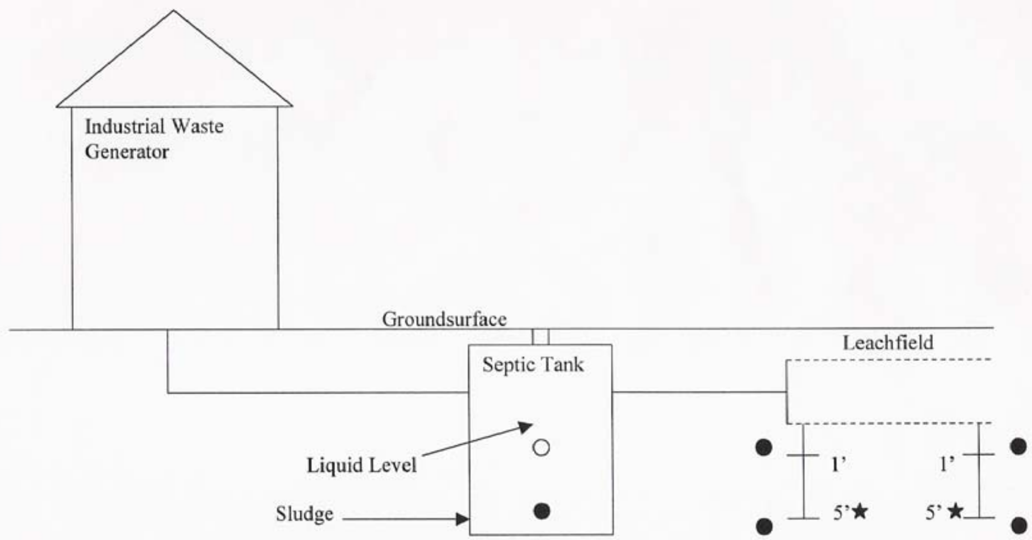
Sampling Locations for a Septic Tank-Leachfield Disposal System Receiving Industrial Wastes



The soil sampling locations shown meet the minimum requirements of the KDHE UIC Program. However, the owner and/or operator is responsible for adequately assessing the extent of any soil or groundwater contamination. This may require additional sampling locations.

FIGURE A-2: SIDE VIEW

Sampling Locations for a Septic Tank-Leachfield Disposal System Receiving Industrial Wastes



● Required soil sampling location

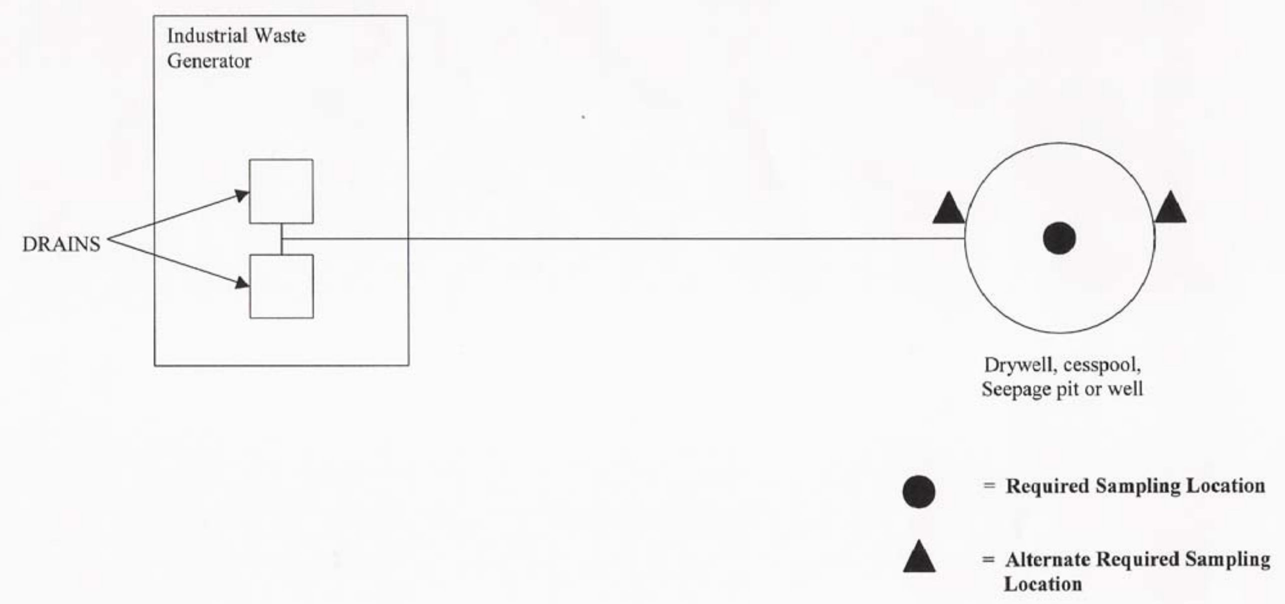
○ Required Water and sludge sampling location

★ Samples have contaminants at level that exceed Concentrations determined acceptable by KDHE.

The sampling locations shown meet the minimum requirements of the KDHE UIC Program. However, the owner and/or operator is responsible for adequately assessing the extent of any soil or groundwater contamination.

FIGURE B-1: PLAN VIEW

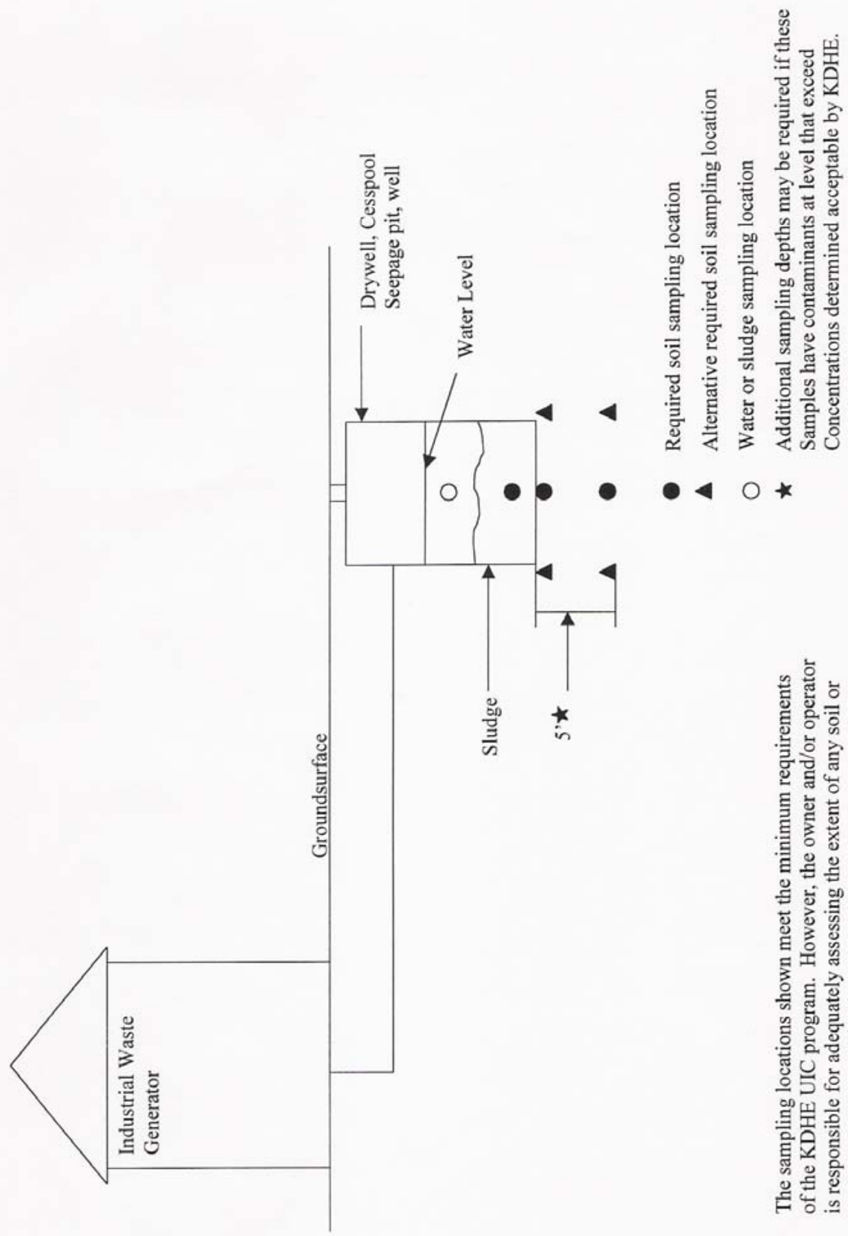
Sampling Locations for a Drywell, Cesspool, Seepage Pit or Well Disposal System receiving Industrial Wastes



The soil sampling locations shown meet the minimum requirements of the KDHE UIC Program. However, the owner and/or operator is responsible for adequately assessing the extent of any soil or groundwater contamination. This may require additional sampling locations.

FIGURE B-2: SIDE VIEW

Compliance Locations for a Drywell, Cesspool Seepage Pit or Well receiving Industrial Wastes



The sampling locations shown meet the minimum requirements of the KDHE UIC program. However, the owner and/or operator is responsible for adequately assessing the extent of any soil or Groundwater contamination.

Kansas Administrative Regulations
Kansas Department of Health and Environment

Notice to Reader

The following regulations represent an electronic facsimile of Kansas Administrative Regulations, promulgated by the Kansas Department of Health and Environment and published by the Kansas Secretary of State. While every effort has been made to assure the accuracy, these electronic copies do not represent the official regulations of the state. The official regulations are the bound copies printed by the Secretary of State.

Where possible KDHE will append changed regulations to the appropriate article. Once again,, the lack of any attachments should not be construed as meaning there are no revisions.

Nothing contained herein should be construed as legal advice by KDHE. If you are.not an attorney. you should secure competent counsel to interpret the regulations and advise you.

Office of Public Information
Kansas Department of Health & Environment

Notes

The *Kansas Register* notes the following Changes:

that will be used in monitoring the proposed well or well system for which application is being made; and

(5) A procedure for plugging the well or wells upon final abandonment of the storage cavity.

(b) For existing projects that have an operational plan on file with the department, only the requirements of paragraphs (1) and (4) of subsection (a) shall be submitted with an application for permit for a new well. The requirements of paragraphs (2), (3), and (5) of subsection (a) shall be submitted for approval when any change in operating procedures is proposed.

(c) Within 20 days after receipt of the proposed plan modification, the secretary shall, in writing, approve the plan as amended, or require such modifications as the secretary deems necessary in order to assure that changes in operation will not cause surface or subsurface water pollution or soil pollution. (Authorized by K.S.A. 65-171d; implementing K.S.A. 65-171d; effective May 1, 1981; amended May 1, 1984.)

28-45-10. Waiver of specific requirements. The secretary may grant an exception to one (1) or more requirements provided in these regulations, if the applicant or operator can show good cause for the granting of such an exception, and presents an alternative to the requirement or requirements which will insure that the objectives of these regulations will be achieved. Requests for an exception shall be made, in writing, to the secretary. The secretary shall grant or deny the re quest within fifteen (15) days of the receipt thereof and shall notify the person requesting the exception, in writing, of the decision. If the request is denied, the secretary will specify in the notice the reasons for the denial of the request. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1981.)

28-45-11. Hydrocarbon storage wells and well systems; fees. An annual fee of $1,200 for permitting, monitoring and inspecting hydrocarbon storage wells and well systems shall be paid by each person, firm, association or corporation operating underground hydrocarbon storage facilities in bedded salt deposits. The fee shall be paid by April 1 of each year. Any person, firm, association or corporation who fails to pay the amount due by April 1 shall be subject to permit revocation. (Authorized by and implementing K.S.A 1984 Supp. 65-171d; effective, T-85-7, Feb. 15, 1984; effective May 1, 1984; amended May 1, 1985.)

Article 46.—UNDERGROUND INJECTION CONTROL REGULATIONS

28-46-1. General provisions. (a) Any reference in these rules and regulations to standards, procedures, or requirements of 40 CFR Parts 124, 136, 144, 145, 146 or 261, shall constitute a full adoption by reference of the part, subpart and paragraph so referenced, including any notes, charts and appendices, unless otherwise specifically stated in these rules and regulations. The materials referenced are available at the Kansas department of health and environment, Topeka, Kansas.

(b) When used in any provision adopted from 40 CFR Parts 124, 136, 144, 145, 146 or 261, references to "the United States" shall mean the state of Kansas, "environmental protection agency" shall mean the Kansas department of health and environment, and "administrator," "regional administrator," or "director" shall mean the secretary of the department of health and environment.

(c) When existing Kansas statutory and regulatory authority is more stringent than the regulations adopted in subsection (a), the Kansas requirements shall prevail. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-2. Definitions. (a) 40 CFR 124.2; 40 CFR 144.3, 40 CFR 144.61, 40 CFR 146.3, and 40 CFR 146.61(b), as in effect on April 1, 1993, are adopted by reference.

(b) "Cone of impression" means the mound in the potentiometric surface of the receiving formation in the vicinity of the injection well.

(c) "Cone of influence" means that area around the well within which increased injection pressures caused by injection into the well would be sufficient to drive fluids into an underground source of drinking water (USDW).

(d) "Fracture pressure" means that wellhead pressure which may cause vertical or horizontal fracturing of rock along a well bore.

(e) "Injection well" means a well into which fluids are being injected.

(f) "Injection well facility" means all land, structures, appurtenances or improvements on which one or more injection wells are located, and that are within the same well field or project.

(g) "Major facility" means, in lieu of the definition in 40 CFR 124.2 and 144.3, a facility capable of producing hazardous waste identified or listed by the secretary under K.A.R. 28-31-3.

(h) "Major permit" means a permit for the underground injection of wastes produced by or stored on a major facility.

(i) "Maximum allowable injection pressure" means the maximum wellhead pressure not to be exceeded as a permit condition, as opposed to fracture pressure.

(j) "Secretary" means the secretary of the Kansas department of health and environment or duly authorized designee. (Authorized by and implementing K.S.A 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-3. Classification of injection wells. 40 CFR 144.6 and 40 CFR 146.5, as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-4. Injection of hazardous or radioactive wastes into or above an underground source of drinking water. Injection of hazardous or radioactive wastes into or above an underground source of drinking water shall be prohibited. Any similar injection taking place before the effective date of these rules and regulations shall be stopped immediately on the effective date of these rules and regulations. The secretary may issue such orders or take such actions as may be appropriate to enforce the provisions of this section. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986.)

28-46-5. Application for injection well permits. 40 CFR 124.3 and 40 CFR 144.31, as in effect on April 1, 1993, are adopted by reference. In addition, the provisions of K.S.A. 65-3437, which relate to hazardous waste injection wells shall be applicable to class I hazardous waste injection wells. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-6. Conditions applicable to all permits. 40 CFR 144.51(a) through (p), as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-7. Draft permits. 40 CFR 124.6, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-8. Fact sheets. 40 CFR 124.8, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-9. Establishing permit conditions. 40 CFR 144.52, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-10. Term of permits. (a) Class I and class V permits shall be effective for a fixed term not to exceed 10 years.

(b) Class III permits shall be issued for a period up to the operating life of the facility.

(c) Each permit shall be reviewed at least once every five years to determine whether it should be modified, revoked and reissued, or terminated, with the exception of permits for class I hazardous waste injection wells which shall be reviewed at least annually to determine whether they should be modified, revoked and reissued, or terminated.

(d) Modification of permits shall not include extension of the maximum duration specified in subsection (a). At the end of the permit term, application shall be filed for a new permit. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended May 1, 1987; amended March 21, 1994.)

28-46-11. Schedules of compliance. 40 CFR 144.53, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-12. Requirements for recording and reporting of monitoring results. 40 CFR 144.54, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-13. Effect of a permit. 40 CFR 144.35, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-14. Transfer of permits. 40 CFR 144.38, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-15. Modification or revocation and reissuance of permits. 40 CFR 124.5 and 40 CFR 144.39, as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-16. Termination of permits. 40 CFR 144.40, as in effect on April 1, 1993, is adopted by reference. (Authorized by K.S.A. 65-171d; implementing K.S.A. 65-165; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-17. Minor modifications of permits. 40 CFR 144.41, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-18. Area permits. 40 CFR 144.33, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-19. Emergency permits. 40 CFR 144.34, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-20. Corrective action. 40 CFR 144.55, 40 CFR 146.7 and 40 CFR 146.64, as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-21. Public notice of permit actions and public comment period; public comments and requests for public hearings; public hearings; response to comments. (a) 40 CFR 124.10 through 40 CFR 124.12; and 40 CFR 124.17, as in effect on April 1, 1993, are adopted by reference.

(b) Any provisions of Kansas law which provide additional opportunity for public comment or public hearing shall supersede the provisions of the federal regulations. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-22. Signatories to permit applications and reports. 40 CFR 144.32, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-23. Claims of confidentiality. (a) Applicants for injection permits may claim confidentiality of information to protect trade secrets. These claims shall be submitted in writing at the time application is made for a permit. Upon agreement between the applicant and the secretary, the confidential information shall be stamped "confidential", and the documents shall not be released to the public by the secretary without the prior written consent of the applicant, to the extent provided by law.

(b) Claims of confidentiality shall not apply to release of confidential materials to governmental agencies with responsibilities in water pollution control or to the release of that material due to a court order.

(c) Prohibition of confidentiality. Claims of confidentiality shall not include the name and address of the applicant or permittee or information dealing with the existence, absence, or level of contaminants in drinking water. (Authorized by K.S.A. 1984 Supp. 65-171d; implementing K.S.A. 65-170g; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986.)

28-46-24. Requirements for wells injecting hazardous wastes. 40 CFR 144.14, as in effect on April 1, 1993, is adopted by reference. In addition to 40 CFR 144.14, the following requirements shall be applicable to class I hazardous waste injection wells.

(a) Liability coverage and long-term assurances. Insurance requirements, closure and post-closure requirements, and financial requirements shall be met by compliance with K.A.R. 28-31-8(a). Higher amounts for insurance, bonds or their equivalent may be required by the secretary.

(b) Injection fluids received from multiple generators. Hazardous waste injection wells shall be subject to the requirements in K.A.R. 28-31-8(d).

(c) Disclosure statement. Each applicant shall be subject to the requirements in K.A.R. 28-31-9(c).

(d) Monitoring fees. The monitoring fee schedule shall be as specified in K.A.R. 28-31-10(c).

(e) Pretreatment requirements. Prior to hazardous waste injection, the fluids shall meet minimum pretreatment requirements that are set by the secretary. To the extent feasible, pretreatment shall render the injected fluid compatible with the injection well tubing and casing and with the disposal formation. In setting minimum pretreatment requirements, the secretary shall consider values 100 times greater than the applicable drinking water standards and values 100 times greater than the applicable 10^{-5} cancer risk levels, or other values necessary to prevent contamination of underground drinking water supplies, to protect the public health, and to take into account environmental considerations. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-25. Prohibition of unauthorized injection. Injection wells shall not be constructed, and underground injection shall not take place, unless authorized by permit, or by rule as provided in K.A.R. 28-46-26. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986.)

28-46-26. Authorization to continue to inject into class V wells. A class V injection well shall be authorized to operate until regulations concerning that class of injection wells are adopted provided the requirements of 40 CFR 144.12, as in effect on April 1, 1993, are satisfied. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-27. Prohibition of movement of fluid into underground sources of drinking water. 40 CFR 144.12, as in effect April 1, 1993, is adopted by reference. (Authorized by and implementing, K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-28. Establishing maximum injection pressure. (a) A maximum allowable injection pressure for each injection well shall be established by the secretary as a permit condition.

(b)(1) All class I wells operating on other than gravity flow shall be prohibited.

(2) In the case of gravity flow, the positive wellhead pressure for a class I well shall not exceed 35 pounds per square inch gauge.

(c) For all wells, the maximum operating pressure shall not be allowed to exceed fracture pressure, except during the development of fractures for well stimulation operations, or during the development of solution-mined wells as defined in K.A.R. 28-43-2(c). (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-29. Construction requirements. 40 CFR 146.12 and 40 CFR 146.65, governing class I wells; and 40 CFR 146.32, governing class III wells, as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-30. Operating, monitoring and reporting requirements. 40 CFR 146.13, 40 CFR 146.67, 40 CFR 146.68 and 40 CFR 146.69, regulating class I wells and 40 CFR 146.33, regulating class III wells, as in effect on April 1, 1993, are adopted by reference. In addition to 40 CFR 144.14 and 40 CFR 146.70, the following requirements are applicable to each class I hazardous waste injection well. (a) Records of the continuously monitored parameters shall be maintained in addition to the monthly average, minimum and maximum values of the following parameters:

(1) injection pressure;
(2) flow rate;
(3) injection volume; and
(4) annular pressure.

(b) Monitoring results shall be reported to the department on a monthly basis.

(c) The necessary number of monitoring wells in appropriate geologic zones for early detection of contaminant migration shall be determined by the secretary. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-31. Information to be considered by the secretary. 40 CFR 146.14, 40 CFR 146.62, 40 CFR 146.66, 40 CFR 146.70 and 40 CFR Part 144 Subpart F, for class I wells and 40 CFR 146.34, for class III wells, as in effect on April 1, 1993, are adopted by reference. In addition to 40 CFR 146.14, 40 CFR 146.62, 40 CFR 146.66, 40 CFR 146.70 and 40 CFR Part 144 Subpart F, the following shall be applicable to class I hazardous waste injection wells:

(a) The provisions of K.S.A. 65-3439, as it relates to hazardous waste injection wells shall be applicable to class I hazardous waste injection wells.

(b) Each applicant shall be responsible for providing all available information necessary for the secretary to determine that well injection of the hazardous waste liquid in question is the most reasonable method of disposal after all other options have been considered.

(1) Factors to be considered in determining the most reasonable method shall include those set forth in K.S.A. 65-3439(d).

(2) All factors considered shall be documented in a detailed report in the format required by the secretary.

(c) The location of each abandoned oil and gas well and exploratory hole within the area of review shall be determined through a detailed record search and field survey.

(1) An interview with those responsible for drilling, producing, plugging, or witnessing the activities shall be a part of the record.

(2) The results of the survey shall be documented in a report in the format required by the secretary.

(3) A map geographically documenting the location of all the holes and abandoned wells within the area of review shall be included as a part of the report. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-32. Area of review. (a) The area of review for each class I hazardous waste injection well shall be no less than 2½ miles or shall extend to the limits of the calculated cone of influence, whichever is greater.

(b) The area of review for each class I nonhazardous waste injection well shall be no less than one mile or shall extend to the limits of the calculated cone of influence, whichever is greater.

(c) The area of review for each class III injection well shall be no less than ¼ mile.

(d) The area of review for each class V injection well shall be no less than ¼ mile. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985;

amended May 1, 1986; amended May 1, 1987; amended March 21, 1994.)

28-46-33. Mechanical integrity testing. (a) A mechanical integrity test consisting of a pressure test with a liquid to evaluate the absence of a significant leak in the casing, tubing or packer and a test to determine the absence of significant fluid movement through vertical channels adjacent to the wellbore shall be required of each class I and class III permittee on each injection well at least once every five years.

(1) For class I hazardous waste injection wells, the mechanical integrity shall be demonstrated by the permittee by:

(A) conducting a pressure test with a liquid of the casing, tubing and packer at least annually and whenever there has been a well workover;

(B) conducting a test of the bottom-hole cement by use of an approved radioactive survey at least annually;

(C) conducting a temperature, noise or oxygen activation log to test for movement of fluid along the borehole at least once every five years; and

(D) conducting a casing inspection log at least once every five years.

(2) The test for class I non-hazardous waste injection wells shall be conducted in accordance with 40 CFR 146.8, as in effect on April 1, 1993.

(3) The test for class III injection wells shall be conducted in accordance with 40 CFR 146.8, as in effect on April 1, 1993, except the casing shall be pressure tested by the use of a mechanical packer or retrievable plug; and the test for class I hazardous waste injection wells shall be conducted in accordance with 40 CFR 146.8 and 40 CFR 146.68(d) as in effect on April 1, 1993.

(b) The permittee shall be notified at least 30 days in advance by the secretary that a mechanical integrity test must be performed, or a permittee may notify the secretary that a voluntary mechanical integrity test will be performed at least 14 days in advance of the test.

(c) The permittee shall be required to cease injection operations immediately and to conduct a mechanical integrity test approved by the secretary if the secretary believes that, due to an apparent problem, the continued use of an injection well constitutes a threat to human health or to waters of the state. Injection operations shall not be resumed until:

(1) the test has been conducted;

(2) it has been demonstrated to the satisfaction of the secretary that the well has mechanical integrity; and

(3) authorization to use the well has been given by the secretary.

(d) A qualified state inspector shall be provided by the secretary to witness all of the pressure mechanical integrity tests performed.

(e) The permittee shall submit results of all mechanical integrity tests to the secretary, in writing, within 30 days after the test has been conducted.

(f) 40 CFR 144.51(p), as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-34. Plugging and abandonment. 40 CFR 144.51(n); 40 CFR 144.52(a)(6), 40 CFR 146.10, 40 CFR 146.71, 40 CFR 146.72 and 40 CFR 146.73, as in effect on April 1, 1993, are adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-35. State inspection and right of entry. (a) Qualified state inspectors to inspect and monitor injection well facilities shall be provided by the secretary.

(b) Duly authorized representatives of the secretary shall have access to injection facilities for all activities required by these regulations. (Authorized by K.S.A. 1984 Supp. 65-171d; implementing K.S.A. 65-170b; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986.)

28-46-36. Waiver of requirements by secretary. 40 CFR 144.16, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-37. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; revoked March 21, 1994.)

28-46-38. Inventory and assessment of class V injection wells. 40 CFR 146.52, as in effect on April 1, 1993, is adopted by reference. (Authorized by and implementing K.S.A. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-39. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; revoked March 21, 1994.)

28-46-40. Exempted aquifers. (a) An aquifer may be designated by the secretary as exempt from protection as an underground source of drinking water. Criteria for exemption may include whether an aquifer:

(1) contains water with more than 10,000 milligrams per liter of total dissolved solid;

(2) produces mineral, hydrocarbon or geothermal energy; or

(3) is situated at a depth which makes the recovery of water economically impractical.

(b) These designations shall be first submitted to and approved by the administrator of the United States environmental protection agency. (Authorized by and implementing K.S.A. 1984 Supp. 65-171d; effective May 1, 1982; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986.)

28-46-41. Sharing of information. 40 CFR 145.14, as in effect on April 1, 1993, is adopted by reference. (Authorized by K.S.A. 65-171d; implementing K.S.A. 65-170g; effective May 1, 1982; amended, T-83-49, Dec. 22, 1982; amended May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-42. Exclusion of oil and gas related wells. The following class II injection wells shall be exempted from the provisions in article 46 of these regulations:

(a) any well which injects fluids brought to the surface in connection with the conventional production of oil or gas;

(b) any well which injects wastewaters from gas plants which are an integral part of production operations, unless those waters are classified hazardous at the time of injection; or

(c) any well which injects fluids to enhance the recovery of oil or natural gas. (Authorized by and implementing K.S.A 65-171d; effective, T-83-7, April 29, 1982; effective May 1, 1983; amended, T-86-47, Dec. 19, 1985; amended May 1, 1986; amended March 21, 1994.)

28-46-43. Analyses to be performed by laboratory certified by the secretary. If a sample analysis is required by the secretary for the purposes of any permit or application for a permit under these regulations, the analysis shall be performed by a laboratory which has been certified and approved by the secretary for conducting such sample analysis. (Authorized by and implementing K.S.A. 65-171d; effective March 21, 1994.)

28-46-44. Sampling and analysis techniques. (a) Sampling and analysis shall be performed in accordance with the techniques prescribed in 40 CFR part 136, as in effect on April 1, 1993, which is adopted by reference.

(b) Where 40 CFR part 136 does not contain sampling and analytical techniques for the parameter in question, or where it is determined by the secretary that the part 136 sampling and analytical techniques are inappropriate for the parameter in question, sampling and analysis shall be performed using validated analytical methods or other appropriate sampling and analytical procedures approved by the secretary.

(c) Alternate sampling and analytical techniques suggested by the permittee or other persons will be considered by the secretary. (Authorized by and implementing K.S.A. 65-171d; effective March 21, 1994.)

Article 47.—USE OF OIL AND GAS FIELD SALT WATER IN ROAD CONSTRUCTION AND MAINTENANCE PROJECTS

28-47-1. Scope. This article regulates the spreading of salt water, originating from the production of oil and gas, in road construction and maintenance projects. (Authorized by and implementing K.S.A 1982 Supp. 55-904; effective, T-83-50, Dec. 22, 1982; effective May 1, 1983.)

28-47-2. Definitions. (a) "Person" means any state, county, township or municipal governing body, and any individual, firm, corporation, partnership, or other association of persons.

(b) "Road" means any highway, county road, township road, or oil or gas company lease road, or any private road under jurisdiction of the applicant.

APPENDIX A

STANDARD OPERATING PROCEDURE BER-01

COLLECTION OF GROUNDWATER SAMPLES AT KNOWN OR SUSPECTED GROUND WATER CONTAMINATION SITES

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-01

COLLECTION OF GROUNDWATER SAMPLES AT KNOWN OR SUSPECTED GROUND WATER CONTAMINATION SITES

Revisor: Travis Kogl ______________________ Date of Revision: August 14, 2000

Remedial Section Chief: ____________________________ Date: ____________

Tank Section Chief: _______________________________ Date: ____________

ARS Section Chief: ________________________________ Date: ____________

Bureau QA Representative: ______________________________ Date:

Bureau Manager:__________________________________ Date: ____________

Revisor: ___________________________________ Date of Revision:

Remedial Section Chief: ____________________________ Date: ____________

Tank Section Chief: _______________________________ Date: ____________

ARS Section Chief: ________________________________ Date: ____________

Bureau QA Representative: ______________________________ Date:

Bureau Manager:__________________________________ Date: ____________

Revisor: ___________________________________ Date of Revision:

Remedial Section Chief: ____________________________ Date: ____________

Tank Section Chief: _______________________________ Date: ____________

ARS Section Chief: ________________________________ Date: ____________

Bureau QA Representative: ______________________________ Date:

Bureau Manager:__________________________________ Date: ____________

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1. INTRODUCTION

The objective of this Standard Operating Procedure (SOP) is to provide general reference information on sampling of ground water wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. These procedures are designed to be used in conjunction with analyses for the most common types of groundwater contaminants (e.g., volatile and semi-volatile organic compounds, pesticides, metals, biological parameters).

2. METHOD SUMMARY

Prior to sampling, the well must be purged. This may be done with a number of instruments. The most common of these are the bailer, submersible pump, non-gas contact bladder pump and inertia pump. At a minimum, three well volumes should be purged, if possible. Equipment must be decontaminated prior to use and between wells. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of several instruments, and need not be the same as the device used for purging. Care should be taken when choosing the sampling device as some will affect the integrity of the sample. Sampling equipment must also be decontaminated. Sampling should occur in a progression from the least to most contaminated well.

3. PROCEDURES

3.1 FIELD PREPARATION

(1) Start at the least contaminated well, if known;
(2) Lay plastic sheeting around the well to minimize the likelihood of contamination of equipment from soil adjacent to the well;
(3) Remove locking well cap, note location, time of day, and date in field notebook or an appropriate log form;
(4) Remove well casing cap;
(5) When appropriate, screen the head-space of the well with an appropriate monitoring instrument to determine the presence of volatile organic compounds (VOCs) and record the instrument response in site logbook;
(6) Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well until water surface is encountered;
(7) Measure distance from water surface to reference measuring point on well casing or protective barrier post and record in site logbook. Alternatively, if there is no reference point, note that water level measurement is from top of steel casing, top of PVC riser pipe, from ground surface, or some other position on the well head.
(8) Measure total depth of well (do this at least twice to confirm measurement) and record in site logbook or on log form;

(9) Calculate the volume of water in the well and the volume to be purged using the calculations in Section 2.8; and

(10) Select the appropriate purging and sampling equipment.

Floating Immiscible Product-- Prior to placing any water level measuring device or reusable bailer in a well, care should be exercised to ensure that free product is not present in the well. A disposable bailer may be lowered into the well to determine the approximate depth to water or depth to floating product. If floating product is observed, there is no need to collect a ground water sample unless specified by a site-specific project plan. An interface probe or a partially submerged, clear PVC bailer should be used to measure the floating product thickness and the depth to water in the well. An attempt should be made to describe the type, color, and viscosity of the product.

3.2 EVACUATION OF STATIC WATER (PURGING)

The volume of water purged from a well prior to sample collection depends on the intent of the monitoring program as well as the hydrogeologic conditions. Programs designed to evaluate overall quality of water resources may require long pumping periods to obtain a sample that is representative of a large volume of that aquifer. The pumped volume can be determined prior to sampling so that the sample is a composite of a known volume of the aquifer, or the well can be pumped until the stabilization of parameters such as temperature, electrical conductance, or pH has occurred.

However, monitoring for definition of a contaminant plume requires a representative sample of a small volume of the aquifer. These circumstances require that the well be pumped enough to remove the stagnant water but not enough to induce flow from other areas. Generally, three to five casing volumes are considered effective. Calculations can be made to determine the appropriate purge volume on the basis of well dimensions and aquifer parameters prior sampling (see Section 3.3). If the well can be pumped or bailed dry, the well should be purged until dry one time and allowed to recover before sampling (Reference 1).
Another approach that may be required by a sampling plan is to monitor one or more indicator parameters such as pH, temperature, or conductivity. The well is considered purged when the parameters stabilize over three or more consecutive measurements. An advantage to this method is that the volume of stored water present has no direct bearing on the volume of water that must be removed. A disadvantage to this approach is that there is no assurance in all situations that stabilized parameters represent formation water (Reference 2). Also, the instruments used to measure the parameters must be adequately maintained and operated.

The following well evacuation devices are most commonly used.

3.2.1 Bailers

Bailers are the simplest purging device and have many advantages. Bailers generally consist of a rigid length of tube, usually with a ball check-valve at the bottom. A line is used to lower the bailer into the well to retrieve a volume of water. The three most common types of bailer are PVC, Teflon, and stainless steel. This manual method of purging is best suited to shallow or narrow diameter wells. For deep, larger diameter wells which require evacuation of large volumes of water, other mechanical devices may be more appropriate.

(1) Determine the volume of water to be purged as described in Section 3.4;
(2) Lay plastic sheeting around the well to prevent contamination of the bailer line with foreign materials;
(3) Attach the line to the bailer and lower until the bailer is completely submerged;
(4) Pull bailer out ensuring that the line either falls onto a clean area of plastic sheeting or never touches the ground;
(5) Empty the bailer into a 5-gallon bucket to measure the volume of water purged; and
(6) Thereafter, pour the water into a container and dispose of purge waters as specified in the site- specific project plan.

3.2.2 Submersible Pumps

Submersible pumps are generally constructed of plastic, rubber, and metal parts which may affect the analysis of samples for certain trace organics and inorganics. As a consequence, submersible pumps may not be appropriate for investigations requiring analyses of samples for trace contaminants. However, they are still useful for pre-sample purging, but the pump must have a check valve to prevent water in the pump and the pipe from rushing back into the well.

Submersible pumps generally use one of two types of power supplies, either electric or compressed gas. Electric pumps can be powered by a 12-volt DC rechargeable battery, or a 110- or 220-volt AC power supply. Those units powered by compressed gas normally use a small electric compressor which also needs 12-volt DC or 110-volt AC power. They may also utilize compressed gas from bottles. Pumps differ according to the depth and diameter of the monitoring wells.

(1) Determine the volume of water to be purged as described in 3.3;
(2) Lay plastic sheeting around the well to prevent contamination of pumps, hoses or lines with foreign materials;
(3) Assemble pump, hoses and safety cable, and lower the pump into the well. Make sure the pump is deep enough so that purging does not evacuate all the water (Running the pump without water may cause damage);
(4) Attach a flow meter to the outlet hose to measure the volume of water purged. If a flow meter is not available, a 5-gallon bucket may be used to measure the volume of water purged;
(5) Attach a power supply, and purge the well until the specified volume of water has been evacuated (or until field parameters, such as temperature, pH, conductivity, etc. have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, and continue pumping; and
(6) Collect and dispose of purge water as specified in the site-specific project plan.

3.2.3 Non-contact Gas Bladder Pumps

To provide the least amount of material interference with the sample, an all stainless-steel and Teflon Middleburg-squeeze bladder pump (e.g., IEA, TIMCO, Well Wizard, Geoguard, and others) is used for the purging procedure. Water comes into contact with the inside of the bladder (Teflon) and the disposable sample tubing. Some wells may have permanently installed bladder pumps (i.e., Well Wizard, Geoguard), that will be used to sample for all parameters.

(1) Assemble Teflon tubing, pump and charged control box;
(2) Use the same procedure for purging with a bladder pump as for a submersible pump; and
(3) Be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.

3.3.3 Suction Pump

There are many different types of suction pumps, including centrifugal, peristaltic and diaphragm. Diaphragm pumps can be used for well evacuation at a fast pumping rate and sampling at a low pumping rate. The peristaltic pump is a low-volume pump that uses rollers to squeeze the flexible tubing, thereby creating suction. This tubing can be dedicated to a well to prevent cross-contamination.

(1) Assemble the pump, tubing, and power source if necessary; and
(2) Follow the procedures outlined for the submersible pump.

3.3.4 Inertia Pump

Inertia pumps (Trilock pump, WaTerra pump and piston pumps) are manually operated. They are appropriate to use when wells are too deep to bail by hand, but are not inaccessible enough to warrant an automatic (submersible, etc.) pump. These pumps are made of plastic and may be either decontaminated or discarded, after use.

(1) Determine the volume of water to be purged as described in Section 2.2, Field Preparation;
(2) Lay plastic sheeting around the well to prevent contamination of pumps or hoses with foreign materials;
(3) Assemble pump, and lower to the appropriate depth in the well;
(4) Begin pumping manually, discharging water into a 5-gallon bucket (or other graduated vessel). Purge until specified volume of water has been evacuated (or until field parameters such as temperature, pH, conductivity, etc. have stabilized); and
(5) Collect and dispose of purge waters as specified in the site-specific project plan.

3.3.5 Domestic and Lawn and Garden Wells

(1) Turn-on a household fixture (preferably an outside faucet) and allow well to discharge for 5 to 10 minutes. Be certain the discharge point is on the well-side of any water conditioning device or screen. Do not sample through garden hoses. Collect the sample directly from the faucet.

If specified by a site-specific project plan, monitor specified field parameters during the evacuation process. When field parameters are within 5 percent over three consecutive readings, the well is considered purged.

3.3 CALCULATIONS

The volume of one well casing of water can be calculated by multiplying the height of the water column (in feet) by the volume of water per linear foot (in gallons per foot). The volume of water in gallons per linear foot for several common sizes of monitoring wells are as follows:

Well Diameter	Volume in gal/ft.
2 inches	0.l632
3 inches	0.3672
4 inches	0.6528
6 inches	l.4688

EXAMPLE
One well volume for a 2" monitoring well with 12 feet of water would be calculated as follows:

12 feet (0.1632 gallons/foot)= 1.9 gallons

Multiply 1.9 gallons by 3 or 5 to obtain the total volume of water to be purged.

The volume, in gallons per linear foot, for other monitoring well diameters can be calculated as follows:

$v = nr^2\ (cf)$

where:
v = volume in gallons per linear foot
n = pi
r = radius of monitoring well (feet)
cf = conversion factor (7.48 gal/ft^3)

Remember to convert the well radius into feet before using this equation.

3.4 SAMPLING

Sample withdrawal methods require the use of pumps, bailers, and samplers. Ideally, purging and sample withdrawal equipment should be completely inert, economical to use, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power resources, and capable of delivering variable rates for sample collection. It should be noted that, regardless of the sampling device (discussed below), all wells at a project should be sampled using the same type of sampling device in order to maintain consistency and to avoid introducing bias.

3.4.1 Bailers

The positive-displacement volatile sampling bailer is perhaps the most appropriate for collection of water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions. Generally, bailers can provide an acceptable sample, providing that sampling personnel use extra care in the collection process.

(1) Attach a line to the bailer. If a bailer was used for purging, the same bailer and line may be used for sampling;
(2) Lower the bailer slowly and gently into the well, taking care not to shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen;
(3) Allow bailer to fill and then slowly and gently retrieve the bailer from the well, avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer;
(4) Remove the cap from the pre-labeled sample container. Do not place the cap on the ground. *See Section 3.1 for special considerations on VOC samples;*
(5) Begin pouring slowly from the bailer or open the stopcock;
(6) Filter samples as required by sampling plan;
(7) Cap the sample container tightly and place sample container in a cooler;
(8) Log all samples in the site logbook and on field data sheets (if necessary);

(9) Complete necessary paper work; and
(10) Transport sample to decontamination zone to prepare it for transport to analytical laboratory.

3.4.2 Submersible Pump

Submersible pumps provide higher extraction rates than any other method, however some agitation in the well should be expected. The possibility of introducing trace metals into the sample from pump materials exists (Reference 2). Many submersible pumps are not appropriate for collecting samples once purging has been performed. VOCs may be removed by aeration by some pumps.

(1) Allow the monitoring well to recharge after purging;
(2) Reduce the flow of water to a manageable sampling rate;
(3) Fill the appropriate bottles;
(4) Cap the sample container tightly and place pre-labeled sample container in a cooler;
(5) Log all samples in the site logbook and on the field data sheets (if required);
(6) Complete necessary paperwork;
(7) Transport sample to decontamination zone for preparation for transport to analytical laboratory; and
(8) Upon completion, remove pump and assembly and fully decontaminate prior to moving to the next well to be sampled.

3.4.3 Non-Gas Contact Bladder Pumps

These pumps are also suitable for shallow (less than 100 feet) wells. They are somewhat difficult to clean, but may be used with dedicated sample tubing to avoid cleaning. These pumps require a power supply and a compressed gas supply (or compressor). They may be operated at variable flow and pressure rates making them ideal for both purging and sampling .

(1) Allow well to recharge after purging;
(2) Assemble the appropriate bottles;
(3) Turn pump on, increase the cycle time and reduce the pressure to the minimum that will allow the sample to come to the surface;
(4) Cap the sample container tightly and place pre- labeled sample container in a carrier;
(5) Log all samples in the site logbook and on field data sheets and label all samples.
(6) Package samples and complete necessary paperwork;
(7) Transport sample to decontamination zone for preparation for transport to analytical laboratory; and
(8) For filtered samples, connect the pump outlet tubing directly to the filter unit. The pump pressure should remain decreased so that the pressure build-up on the filter does not blow out the pump bladder or displace the filter. For the Geotech barrel filter, no actual connections are necessary so this is not a concern.

3.4.4 Suction Pumps

In view of the limitations of suction pumps, they are not recommended for sampling purposes.

3.4.5 Inertia Pumps

Inertia pumps may be used to collect samples. It is more common, however, to purge with these pumps and sample with a bailer.

(1) Following well evacuation, allow the well to recharge.
(2) Assemble the appropriate bottles.
(3) Since these pumps are manually operated, the flow rate may be regulated by the sampler. The sample may be discharged from the pump outlet directly into the appropriate sample container.
(4) Cap the sample container tightly and place pre-labeled sample container in a carrier.
(5) Log all samples in the site logbook and on field data sheets and label all samples.
(6) Package samples and complete necessary paperwork.
(7) Transport sample to decontamination zone for preparation for transport to analytical laboratory.
(8) Upon completion, remove pump and decontaminate or discard, as appropriate.

3.5 SPECIAL CONSIDERATIONS FOR VOC SAMPLING

The proper collection of a sample for volatile organics requires minimal disturbance of the sample to limit volatilization and therefore a loss of volatiles from the sample. Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers. Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must be to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible. The following procedures should be followed:

(1) Open the vial and collect the sample during the middle of the cycle. When collecting duplicates, collect both samples at the same time.
(2) Fill the vial to just overflowing. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.
(3) Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not overtighten and break the cap.
(4) Invert the vial and tap gently. Observe the vial for a few seconds. If an air bubble appears, discard the sample and begin again. It is imperative that no air bubbles are present in the sample vial.
(5) Immediately place the vial in the protective sleeve (if available) and place into the cooler, oriented so that it is lying on its side, not straight up.
(6) The holding time for unpreserved VOAs is 7 days. Samples should be shipped or delivered to the laboratory daily so as not to exceed the holding time. Ensure that the samples remain at 4°C, but do not allow them to freeze.

3.6 FILTERING

For samples that require filtering, such as samples which will be analyzed for total metals, the filter must be decontaminated prior to use and between uses. Filters work by two methods. A barrel filter such as the "Geotech" filter works with a pump, which is used to build up positive pressure in a chamber containing the sample. The sample is then forced through filter paper (minimum size 0.45 μm) into a sample container placed underneath. The barrel itself is filled manually from the bailer or directly via the hose of the sampling pump.

A vacuum type filter involves two chambers, an upper chamber that contains the sample, and a filter (minimum size 0.45 μm) divides the chambers. Using a hand pump or a Gilian-type pump, air is withdrawn from the lower chamber, creating a vacuum and thus causing the sample to move through the filter into the lower chamber where it is drained into a sample jar. Repeated pumping may be required to drain all the sample into the lower chamber. If preservation of the sample is necessary, this should be done after filtering.

3.7 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Complete preservation of samples is practically impossible. At best, preservation techniques only retard the chemical and biological changes which occur after a sample is removed from the source. Therefore, insuring a timely analysis of a sample should be one of the foremost considerations in the sampling plan schedule. For ground water samples, immediate refrigeration to 4° C is often the best preservation technique available, but it is not the only measure nor is it applicable in all cases. Table 1 summarizes typical container and preservation requirements for ground water samples. The requirements for sample volumes and number of containers vary from laboratory to laboratory. A site specific project plan will determine the appropriate sample containers and preservatives. Samples should be collected directly from the sampling device into the appropriate laboratory-cleaned containers unless filtering is required. Complete a field data sheet (if required), a chain of custody form, and record all pertinent data in the site logbook.

Chain-of-Custody Records must be used to record the custody and transfer of samples. These forms must be entirely completed (N/A if not applicable). If directed by the site specific sampling plan, tamper-proof seals will be placed on either sample containers or shipping coolers. The seal number must be recorded on the Chain-of-Custody Form.

4. POST OPERATION

After all samples are collected and preserved, the sampling equipment should be decontaminated prior to sampling another well. This will prevent cross-contamination of equipment and monitoring wells between locations.

(1) Decontaminate all equipment according to Standard Operating Procedure BER-05;
(2) Replace sampling equipment in storage containers; and
(3) Prepare and transport water samples to the laboratory. Check sample documentation and make sure samples are properly packed for shipment to a laboratory.

5. QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

6. HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures. More specifically, depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. The site health and safety plan should be reviewed with specific emphasis placed on the protection program planned for the well sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants in both the vapor phase and liquid matrix through the use of respirators and disposable clothing.

For volatile organic contaminants:

- Avoid breathing constituents venting from the well;
- When appropriate, survey the well head-space with an FID/PID prior to sampling; and
- If monitoring results indicate organic constituents, sampling activities may be conducted in Level C protection. At a minimum, skin protection will be afforded by disposable protective clothing.

Physical hazards associated with well sampling are:

- Lifting injuries associated with pump and bailer retrieval, and moving equipment;
- Use of pocket knives for cutting discharge hose;
- Heat/cold stress as a result of exposure to extreme temperatures (may be heightened by protective clothing);
- Slip, trip, fall conditions as a result of pump discharge; and
- Restricted mobility due to the wearing of protective clothing.

7. REFERENCES

1. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Compendium of ERT Ground Water Sampling Procedures,* EPA designation EPA/540/P-91/007, January 1991.

2. American Society for Testing and Materials, 1992, *Standard Guide for Sampling Ground Water Monitoring Wells,* ASTM Designation D4448-85a.

Appendix C

STANDARD OPERATING PROCEDURES BER-03

**COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS**

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-03

COLLECTION OF SOIL SAMPLES FOR LABORATORY ANALYSIS

Revisor: Farrell Dallen **Date of Revision:** February 15, 2000

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Tank Section Chief: _______________________________ **Date:** ____________

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1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from hand auger samplers, slide-hammer samplers, grab samples from stockpiled soils, surface samples, test pit samples, etc. To collect soil samples from split-spoon samplers during drilling refer to SOP BER 06. To collect soil samples using a Geoprobe refer to SOP BER 07.

2. CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact, points required to meet regulatory compliance or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth, the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected, surrounding terrain, and accessibility. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a depth interval of 0 to 12 inches. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths, a bucket auger, power auger, or slide-hammer may be needed to advance the hole to the point of sample collection. To collect samples at depths, greater than what's practical using hand equipment, the use of a drill rig with a split spoon sampler or a Geoprobe with a soil sampler may be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3. MATERIALS/EQUIPMENT

The following materials may be used:

(1) A work plan which outlines soil sampling requirements.
(2) Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

(3) Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, de-ionized or distilled water, regulatory-required reagents, etc.)

(4) Sampling device (stainless steel hand auger, slide-hammer soil sampler, stainless steel trowel, etc.).

(5) Stainless steel spoons or spatulas.

(6) Disposable sampling gloves.

(7) Laboratory-supplied sample containers with labels.

(8). Cooler with blue or wet ice.

(9) Plastic sheeting.

(10) Black pen and indelible marker.

(11) Zip-lock bags and packing material.

(12) Tape measure.

(13) Paper towels or clean rags.

(14) Masking and packing tape.

(15) Overnight (express) mail forms (if needed).

4. DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to KDHE's decontamination SOP, BER-05. Disposable items such as sampling gloves and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5. PROCEDURE

(1) Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP BER 05.

(2) Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon for each sample, extract the soil sample from the sampler. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

(3) Place the sample in a laboratory-supplied, pre-cleaned sample container. Collection of soil samples for volatile organic compounds (VOC) analysis should be made directly into a sample jar or a sample liner placed in the sampler to be submitted directly to the laboratory. Lids of sample jars must have a Teflon liner. When using sample liners, Teflon film should be placed between the sample and the cap.

(4) The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

(5) If soil samples are to be composited, the samples can be composited either in the field or the laboratory. To composite soil samples in the field, equal portions of the sample, either by volume or weight, must be collected from selected sampling locations. The discrete sample portions must be placed either on a plastic sheet or in an appropriate container, such as an aluminum or stainless steel pan, in order to homogenize the sample. If placed on a plastic sheet, the sample will be homogenized by quartering the sample by the repeated diagonal folding of the corners. If placed in a container, the sample will be homogenized by mixing with an appropriate tool such as a stainless steel spoon. Mixing is often not complete with heavy or wet soils. Soils may have to be dried and pulverized prior to compositing. Alternately to compositing in the field, several discrete samples may be submitted to the laboratory for compositing. The method used may be dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. **Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.**

(6) After the sample has been collected and put into a container, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

(7) A chain-of-custody form is completed for all samples collected.

(8) Soil samples should be delivered to the laboratory as soon as practicable. Check the work plan to determine if any analytes require a particular delivery or holding time.

(9) If field-based analysis or field screening are being made on the soil samples, follow the appropriate SOP: Mobile Laboratory-BER 07; x-ray fluoresence metal analysis-BER 27; screening for VOC vapors using a PID or colorimetric tubes-BER 13.

(10) The field notebook and appropriate forms should include, but not be limited to the following: site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

(11) All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Discard any disposable material or waste generated at the site in an appropriate manner that is consistent with site conditions.

APPENDIX D

STANDARD OPERATING PROCEDURE BER-04

COLLECTION OF SEDIMENT SAMPLES

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-04

COLLECTION OF SEDIMENT SAMPLES

Revisor: Farrell Dallen ______________ Date of Revision: February 15, 2000

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1. INTRODUCTION

For the purposes of this procedure, sediments are those mineral and organic materials situated beneath an aqueous layer. The aqueous layer may be either static, as in lakes, ponds, or other impoundments or flowing, as in rivers and streams.

Sediment samples are valuable for locating pollutants of low water solubility and high soil binding affinity. Where surface water might show trace quantities of contaminants, thus leading investigators to believe that off-site contaminant migration is minor, the analysis of sediments might show otherwise. Heavy metals and high molecular weight hydrocarbons are examples of contaminants which might be found in greater concentrations in sediments than in the stream water.

Substrate particle size and organic content are directly related to water velocity and flow characteristics of a body of water. Contaminants are more likely to be concentrated in sediments typified by fine particle size and a high organic content. This type of sediment is most likely to be collected from depositional zones. In contrast, coarse sediments with low organic content do not typically concentrate pollutants and are found in erosional zones. The selection of a sampling location can, therefore, greatly influence the analytical results.

It is important to note that the sediments obtained from surface impoundments, such as lagoons, which are suspected to be highly concentrated are to be handled and treated as hazardous (concentrated) materials samples. This section addresses collecting those samples that can be treated and handled as environmental samples.

2. EQUIPMENT

Aluminum pie pans
Aluminum Foil
Bucket Auger with butterfly valve (extension handle)
Camera 35mm and film
Chain-of-Custody Seals
Coolers
Dredge (Ekman or Ponar)
Glass Jars (8 oz. wide mouth w/Teflon lined caps)
Labels
Measuring Tape
Mobile Soil Drill
Plastic Sheets/Tarps
Pliers (10" forged slip joint, 8" lineman's, 8" long nose, and 8" slip joint)
Pocket Knife
Posthole Digger
Rope (Nylon)
Safety Equipment

Scoop
Shovel
Spatula
Split Spoon Sampler
Survey Flags of Buoys + Anchors
Tool Box
Vials
Wooden Spoons

3. APPROACH

The review of background information gives an indication of the types of substances which may be present in sediments. The following items should be considered when sampling.

(1) Many pollutants adsorb onto sediments having a large surface-to volume ratio. Therefore, silts and clays will contain higher concentrations of organic compounds and trace metals than coarser sediments such as sands and gravels.

(2) Hydrogeologic information should be recorded which can help establish a relationship between the contaminant source and the contaminants in sediments.

(3) Samples for organic analyses should not be collected from areas exposed to the air during periods of low flow or low recharge.

(4) The pH of the surface water over the sediments should be determined to identify any unusual pH conditions which would influence contaminant mobility and retention by the sediments.

(5) Sediment samples should be obtained from the area nearest the suspected contaminant point source.

(6) Background sample(s) should be obtained from sediments upstream from the suspected point source for running water, and from sediments away from the suspected point source for standing surface water. In cases of high contamination of small bodies of standing water, it may be impossible to find a background sample. The analysis of background sediments is required to establish the contribution of the source to contaminant levels in the area.

(7) Chemical preservation of solids is generally not recommended. Cooling is usually the best approach, supplemented by the appropriate holding time.

4. TECHNIQUES

Very simple techniques can usually be employed for sediment sampling. Selection of a sampling device is most often contingent upon: 1) the depth of water at the sampling location, and 2) the physical characteristics of the medium to be sampled. Most samples will be grab samples, although sometimes sediment taken from multiple locations may be combined into one sample to reduce the amount of analytical support required. Composited samples are not acceptable for VOC analysis. Suggested techniques include the following:

(1) In small, low-flowing streams or near the shore of a pond or lake, a sample container (8-ounce wide-mouth jar) may be used to scrape up the sediments. Collect 4 to 8 ounces of material.

(2) To obtain sediments from larger streams or farther from the shore of a pond or lake, a Teflon beaker attached to a telescoping aluminum pole by means of a clamp may be used to dredge sediments. In most circumstances, a number of sediment samples should be collected along a cross-section of a river or stream to characterize the bed material. A common procedure is to sample at quarter points along the cross-section of the site selected. When the sampling technique or equipment requires that the samples be extruded or transferred at the site, they can be combined into a single composite sample. However, samples of dissimilar composition should not be combined, but should be stored for separate analysis in the laboratory.

(3) To obtain sediments from rivers or in deeper lakes and ponds, a spring-loaded sediment dredge or benthic sampler may be used by lowering the sampler to the appropriate depth with a rope. The sediments thus obtained are placed into the sample container. When collecting sediment samples in lakes, ponds, and reservoirs, the site selected should be approximately at the center of water mass. This is particularly true for reservoirs that are formed by the impoundment of rivers or streams. Generally, the coarser grained sediments are deposited near the headwaters of the reservoir, and the bed sediments near the center of the water mass will be composed of fine-grained materials. The shape, inflow pattern, bathymetry, and circulation must all be considered when selecting sediment sampling sites in lakes and reservoirs. In rivers or streams, fine grained sediments are deposited on the inside of bends and downstream from islands and other obstructions.

(4) The sampling device should be decontaminated between locations according to KDHE SOP BER-05.

(5) When sampling sediment from bodies of water containing known or suspected hazardous substances, adequate precautions must be taken to ensure the sampler's safety. The team member collecting the sample should not get too close to the edge of the water, where bank failure may cause him or her to lose their balance. To prevent this, the person performing the sampling should be on a lifeline, and be wearing adequate protective equipment. If sampling from a vessel is necessary, implement appropriate protective measures.

APPENDIX E

STANDARD OPERATING PROCEDURE BER-05

DECONTAMINATION OF EQUIPMENT

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-05

DECONTAMINATION OF EQUIPMENT

Revisor: Travis Kogl ______________________________ **Date of Revision:** October 17, 2000

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1. INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to establish a consistent process for decontamination of sampling equipment to prevent cross-contamination between sampling locations and events. Preventing cross-contamination in samples is important for reducing the introduction of error into sampling results, and for protecting the health and safety of site personnel.

2. METHOD SUMMARY

Gross contamination of equipment requires physical removal by methods such as brushes and high pressure water. This is followed by washing and rinsing the equipment.

3. PROCEDURE

(1) When applicable, gross contamination should be removed with a metal or nylon brush and/or high pressure water spray.

(2) Wash equipment with a non-phosphate detergent solution such as alconox or an equivalent.

(3) Rinse with tap water.

(4) Final rinse with deionized water.

4. GENERAL CONSIDERATIONS

(1) The use of distilled or deionozed water commonly available from commercial vendors is acceptable for decontamination of sampling equipment, provided that it has been verified by laboratory analysis to be analyte free.

(2) Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

- Stress work practices that minimize contact with hazardous substances.

- Use appropriate personal protective equipment (e.g. gloves) when handling contaminated equipment.

- Use disposable sampling equipment when appropriate.

(3) Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing between sampling locations.

(4) As part of the work plan or health and safety plan, develop a decontamination plan before any personnel or equipment enter areas of potential exposure. The equipment decontamination plan may include:

- the number, location and layout of decontamination stations;

- which decontamination apparatus is required;

- methods for disposal of contaminated clothing, disposable equipment and water.

5. SPECIAL CONSIDERATIONS

Sample containers used by KDHE/BER personnel will be decontaminated by the laboratory or vendor from which the containers are obtained. The exception are brass liners used for Geoprobe closed-piston soil samplers and AMS core soil samplers. Contaminated brass liners will first be decontaminated as described in Section 3, then will be heated at 105° C for a minimum of one hour. New liners received from a vendor will be considered analyte-free.

APPENDIX G

STANDARD OPERATING PROCEDURES BER-07

KDHE GEOPROBE OPERATIONS

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-07

KDHE GEOPROBE OPERATIONS

Revisor: __Farrell Dallen__________________________ **Date of Revision:** __July 3, 2000__

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1. INTRODUCTION

This document describes minimum operating requirements and recommended techniques for use of the 5400 Geoprobe and the 4200 Geoprobe units. Procedures which are mandatory, due to safety considerations or to minimum requirements for accuracy, are described in terms of **will** or **must**, while recommendations for good operating technique, efficiency, or enhanced accuracy, are worded as activities that the operators **should** or **may** perform.

The procedures assume that two assigned persons will perform all of the necessary activities to operate the equipment, and that they are familiar with the use of the mechanical and analytical equipment and with scientific investigations of contamination sites. These operating procedures are not intended to substitute for training or experience, but to outline the reasonable minimum requirements for performing routine investigations with the equipment. The operators are expected to use their informed and reasonable judgement to interpret and implement the procedures, and to develop means to solve unforeseen problems as they arise.

2. SAMPLING PROCEDURES

2.1. Probe Equipment Operation

2.1.1. Safety Considerations

The probe operator is the primary person to monitor for personnel safety in operating the vehicle and hydraulic probe system. Among the safety considerations are the following:

--A safe working area must be maintained when operating the sampling equipment in a street or public traffic area. Traffic cones should be used to close a lane if necessary, and good visibility for drivers and KDHE staff should be maintained around the work area.

--Hands and feet of operators and bystanders must be kept clear of moving parts, such as the probe foot and the drive head. Care must also be taken to prevent damage to the probe or the vehicle in extending and storing the probe. Unauthorized persons are not to be allowed to operate the hydraulic equipment.

--All work sites must be cleared for underground utilities and buried equipment before the probe is driven. 1-800-DIG-SAFE **must** be called to clear buried utilities. A Utilities Clearance Form must be completed and included in the project file.

--The Geoprobe units are much larger and heavier than most personal vehicles, and may handle awkwardly in some situations. Drivers should keep the size and limitations of the units in mind at all times to avoid accidents.

2.1.2. Routine Equipment Maintenance

The probe operator should perform routine maintenance checks daily and weekly when operating the units. Daily checks should include:

--Drain water from the vacuum tank and check the vacuum system for leaks. The vacuum tank should be pumped to approximately 22" Hg vacuum, and should hold a vacuum without noticeable loss for at least 20 minutes.

--Check the hydraulic system for obvious leaks, and maintain the equipment in a clean and serviceable condition. In particular, oil and grease should not be allowed to accumulate where it can contact the probe rods, rod caps, or sampling tools and equipment.

Weekly maintenance checks should also address the following:

--Check the vehicle's motor oil and transmission fluid and refill if necessary.

--Check and refill the hydraulic fluid if necessary.

--Watch for damage to mechanical equipment (i.e. rods and hoses.) Hydraulic equipment and hoses must be inspected for cracks or damage to prevent mechanical failure, personnel injury, or down hole contamination.

2.2. Operating Procedures

Quality and integrity of the samples will be a principal concern of the operator, second only to personnel safety. Principal sources of error in sampling include contamination of tools or sampling equipment, air leaks caused by poorly fitting probe connections or leaky sample tubing, and improper sampling, such as trying to sample an impermeable or water saturated zone for soil gas.

2.2.1 Probe Operating Technique

It is good operator technique to turn off the hydraulic system switch to relieve pressure on the system and save fuel whenever the hydraulics are not in use. The operator should also turn off the vehicle engine whenever it is not in use to reduce exhaust fumes and noise in the working area. The drive hammer should be operated only when there is

weight applied to the probe by the drive head. Use of the hammer without a load on the drive head causes undue wear and possible damage to the hammer and probe equipment. The drive head must not be allowed to lift the foot of the probe off the ground more than 6" to 10". Lifting the foot off the ground too high will lift the rear wheels of the van from the ground, causing an unsafe condition that may allow the van to fall in any direction, possibly injuring personnel and damaging equipment. The units should be operated with the hydraulic system switch set at low speed when folding in and out of the vehicle and when advancing the initial probe rod.

2.2.2. Operator Log Book

The probe operator should maintain a field log book or maintain a file with the following information about each sample collected:

--The names of all field personnel
--The project name or location
--A sample identification number
--Date and time that the sample was taken
--The location and depth of the sample
--The type of sampling performed (soil gas, water, soil, vertical profile)
--Weather and site conditions, if they are relevant
--Other information, including drilling through pavement or rocks if necessary, tool or equipment breakage, stains and odors noted at the site, and problems encountered.

If the project manager is keeping a field log book that contains this information, the probe operator does not need to duplicate the effort.

2.3. Soil Gas Sampling

The vacuum line should be checked frequently during soil gas sampling operations to ensure that no leaks are present, particularly in the silicone rubber sample tube. To check for leaks, the operator should plug the end of the sample tube, apply a vacuum from the vacuum system, and close the sample line valve. The sample vacuum gauge should not show any visible movement for at least 30 seconds. The silicone rubber sample tube should be inspected frequently for visible damage due to needle punctures or contamination. O-rings on the sample caps should be checked for damage.
The operator should note the reading of the line vacuum gauge after the purge is completed and the line valve closed. A slow recovery to atmospheric pressure indicates a low permeability which does not easily yield soil gas. If the time required for the pressure recovery is more than 30 seconds, the operator should record the recovery time in his log book. If the recovery time exceeds 5 minutes, the sample should not be taken. Alternative sampling techniques should be attempted, such as withdrawing the probe rods

farther to permit more exposure of the soil and sampling at a different depth above or below the impermeable zone. If no sample is obtainable, the site may not be amenable to soil gas sampling. Other techniques such as soil sampling or water sampling may be more effective.

After the probe has been driven to the sampling depth, the operator will withdraw the probe rods a distance sufficient to obtain the necessary purge volume and sample. This distance will be determined by the operator, and will depend on the permeability of the soil at the level to be sampled. When the sample is to be taken from relatively impermeable soil such as moist clay, the withdrawal distance will be as much as three feet or more. When permeable soils are sampled, the withdrawal distance may be three inches or less. If a vertical profile of soil gas is planned, the operator should attempt to take a sample while the probes remain seated on the expendable drive point. Withdrawal distance should be uniform for all probes at a given location whenever possible.

The operator will connect the vacuum line using a replaceable connector of silicone rubber and a sampling cap. A predetermined volume of air will be withdrawn from each probe location prior to sampling. The purge volume should be selected before the site sampling begins, and will be equal to three probe rod volumes. The operator should note the time required for the probe sample pressure to recover to atmospheric pressure. If this recovery time exceeds 30 seconds, the actual recovery time should be noted in the sample log. No sampling should be performed until the pressure in the probe has completely recovered. If the recovery time exceeds 5 minutes, no sample should be taken at the site.

Following recovery of the probe pressure, the sample tube should be sealed with a pinch clamp to prevent possible back flow of air into the probe. Samples will be taken either with a syringe for immediate analysis or in a serum bottle for a duplicate analysis or for laboratory analysis.

Reusable syringes or disposable insulin syringes may be used for routine sampling. The syringe needle is inserted through the silicone rubber tubing directly into the sample cap, and the plunger pulled out carefully to completely fill the syringe. The full syringe should then be passed to the chemist for analysis. Normally, the syringe should not be filled until the chemist is ready to inject the sample into the gas chromatograph (GC). In handling the disposable syringes, the needle cap should be left in place until the sample is taken, and the syringe needle should not be allowed to contact any surfaces except the sampling tube and the GC injection port. The syringes should be safely disposed of immediately after use. When using reusable syringes, adequate quality control procedures must be observed to assure that carry-over does not occur when highly contaminated samples are analyzed.

When duplicate samples are required or when it is otherwise desired to capture a larger sample, 50 ml serum bottles may be used. The bottles will normally be decontaminated, sealed, and a vacuum applied prior to leaving for fieldwork. Decontamination for the bottles will be by washing the bottles thoroughly to remove any visible dirt, and heating them with open caps to 90°C. for at least 30 minutes. Following decontamination, the bottles will be sealed with TFE-lined septa and crimped-on caps. A blank will be run on at least 5% of the sealed bottles prior to applying a vacuum. The vacuum will be applied with a laboratory vacuum pump capable of at least 27" Hg vacuum if possible, using a hypodermic needle to withdraw air pressure. If necessary, serum bottles may be decontaminated, sealed, blanked, and evacuated in the field using the vacuum pump in the soil gas van. This vacuum pump is capable of approximately 22" Hg vacuum. All sample bottles for a particular project must be prepared using the same equipment and techniques.

The sealed, evacuated serum bottles will be used with double-ended Vacutainer needles for taking samples. The needle should be inserted through the sample tube, leaving the rubber covered end exposed. The sample bottle will then be inserted onto the needle, and will be allowed to equalize pressure for a minimum of 20 seconds. The serum bottle should then be labeled appropriately and passed to the analyst for analysis or storage. The double-ended needles should be safely disposed of and will not be reused.

2.4. Ground Water Sampling

Water samples may be collected directly from the rod string by using either a slotted rod or the 15-point sampling system (drop out screen). A pre-probe may precede the slotted rod if the operator feels it is necessary. After the probe has been driven to the desired sampling depth, an electronic static water level indicator may be used to check for ground water in the probe rods. A polyethylene tube will be inserted inside the rods with a check valve attached. The tube can act as an inertia pump by physically moving the tube up and down inside the rods. Once the desired amount of water is purged from the probe, samples may be collected.

All water samples other than volatile organic chemical(VOC) samples may be collected by pumping directly into the sample container or into another container such as a cube container for heavy metal samples prior to filtering. To collect VOC samples, the tube is pinched off at the top to retain the sample in the tube. The tube is pulled out of the rod with care being taken to avoid the tube touching the ground or any source of contamination. The check valve is removed from the tube. One sampler holds the VOC vial at the bottom end of the tube. A second sampler holds the pinched end of the tube and controls the flow of the sample from the tube to the VOC vial by releasing pressure on the pinched area of the tube and adjusting the height of the tube to allow proper sample flow into the VOC vial. Samplers must wear sampling gloves while performing this operation.

The vacuum system may be used to purge the system and to collect samples instead of using the check valve system. With the vacuum system the samples may be drawn directly into the sample container or poured from a clean purge bottle. It is not recommended to use the vacuum system to collect VOC samples.

If the geology is such at the site that ground water is not easily obtained in the probe rods, a temporary well maybe set by removing the probe rods and inserting 0.5" schedule 80 PVC screen and casing.

All samples are to be properly preserved and stored until they reach the laboratory.

2.5. Soil sampling

KDHE has the capability to collect soil samples using three different methods with the geoprobe–the Large Bore Soil Sampler, the Macro-Core Sample, or the Dual Tube Method.

The Large Bore Soil Sampler is a closed piston sampler used for sampling at discrete depths. When collecting soil samples using the Large Bore Soil Sampler, which is a two-foot sampler, the sampler will be pushed in front of the push rods. The Large Bore Soil Sampler can be lined with either an acetate liner or a brass liner. The sampler is pushed to the top of the desired collection depth. The stop pin holding the piston in place is removed through the center of the rods. The sampler is advanced into the ground an additional two feet. The hammer is activated to start the pushing in order to open the

piston so the sample will enter the sampler. After the rods have been pushed the additional two feet, the rods are pulled out of the ground. The liner is removed from the sampler and the sample is transferred to the appropriate sample containers. The brass liner is four six-inch sections held together with heat-shrink tubing that can be snapped apart and used for sample containers if the laboratory will accept them. If the sample is being analyzed for VOCs, the ends of the sections should be immediately covered with either teflon film or aluminum foil and capped. If the acetate liner is being used to collect samples for VOC analysis, the sample should be transferred to the sample container with as little aeration as possible and the container must be packed as air tight as possible. Using brass liners is the preferred method for the collection of VOCs, because of the loss of VOCs in the plastic and during transferring the sample to a glass container.
The Macro-Core sampler is a continuous core sampler. The four-foot sampler can be used as an open tube sampler or a closed-piston sampler. When used as an open tube sampler, a continuous sample is collected in four feet sections from the surface to the desired depth. When used as a closed-piston sampler, a sample is collected from the

surface to four feet depth with the sampler used as an open tube sampler. The piston tip assembly is installed on the sampler. The sampler is driven to a 4-foot depth, and the piston tip assembly is released to allow soil to enter the sampler while being driven from the 4-foot depth to an 8-foot depth. The sampler is re-assembled with the piston tip assembly and the process is repeated until the desired depth is reached. **The Macro-Core sampler cannot be advanced through undisturbed soil with the piston tip assembly in place. The system is designed to be advanced with the piston assembly in place through previously open holes only.**

The Dual Tube method involves advancing a sample tube held in place with smaller probe rod inside 2.125 inch probe rod (rod used to set micro-wells), hence the name Dual Tube. The Dual Tube system can be used to collect soil samples for soil analysis or logging while installing mini wells. Continuous coring can be performed in both saturated and unsaturated zones. Bottom up grouting can be performed while retraction the outer casing.

2.6. Direct Sensing-Soil Conductivity and Membrane Interface Probe

The direct sensing system can be used with the Membrane Interface Probe (MIP) or a conductivity probe. The MIP system is capable of simultaneous measuring soil conductivity and volatile organic compounds. The MIP system components consist of a Gas Chromatograph(GC), MIP control module, string-pot to measure depth, a lap top computer to operate the system and to collect data, and a combination probe containing a membrane contact zone and a conductivity sensor.

The system is operated by running a harness, that contains wiring for the conductivity sensor and tubing for carrier gas to the membrane contact zone, through the probe rods (the harness has to be threaded through enough probe rod prior to connecting up the system to reach the desired depth). The wiring for the conductivity sensor is connected to the control box. The carrier gas tubing is connected to a ultra pure nitrogen tank and goes down-hole to the membrane contact zone. From the membrane contact zone the tubing goes up-hole to the GC and is connected directly to the detector, bypassing the GC column.

When operating the MIP system, the mobile laboratory is parked next to the geoprobe in order to connect the system to the mobile laboratory GC and to run the control module off the mobile laboratory's generator. The MIP system operates with 110 volt electricity.

If only soil conductivity is desired, a conductivity probe is used to save wear and tear on the more expensive MIP probe. The system operates similar to the MIP system without the GC being involved. Since the same control box is used for both systems, either the mobile laboratory or a portable generator is needed for the electrical source.

2.7. Micro-Well Installation

To install micro-wells using a Geoprobe, refer to SOP BER 28.

APPENDIX H

STANDARD OPERATING PROCEDURE BER-08

CHARACTERIZATION AND DISPOSAL OF INVESTIGATIVE DERIVED WASTE

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-08

CHARACTERIZATION AND DISPOSAL OF INVESTIGATIVE DERIVED WASTE

Revisor: Randolph L. Brown **Date of Revision:** November 6, 2000

Remedial Section Chief: ____________________________ **Date:** ____________

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1. INTRODUCTION

This guidance provides general options for management of investigation-derived wastes (IDW) generated during the investigation of potential or actual contaminated sites. These wastes include soil cuttings, drilling muds, and other materials. The general process for characterization and disposal of IDW is outlined on the attached flow chart. Individual project managers and/or programs may have additional requirements.

2. METHOD SUMMARY

In the process of collecting environmental samples during investigations, field staff may generate many different types of potentially contaminated IDW. This SOP is to be used to assist project managers and field staff in their decision making. Project managers should use EPA Guidance Document EPA/540/G-91/009, "Management of Investigation-Derived Wastes" for additional information concerning disposal of IDW.

3. PROCEDURE

Analysis of IDW should be conducted using KDHE-approved methodologies and technologies. Laboratory analysis should be performed according to EPA SW-846 8000 Series (solids or liquids) or 600 series (waste water). Type and frequency of laboratory analysis should be approved on a site-specific basis by the KDHE Project Manager. Use of field analytical technology is encouraged and should be chosen on a site-specific basis considering the constituents of concern and analytical equipment limitations. Use of field analytical equipment, type and frequency of confirmatory laboratory analysis should be approved on a site-specific basis by the KDHE Project Manager. The appropriate BER SOP should be consulted for sampling methods for actual or potentially contaminated media generated as IDW.

4. GENERAL CONSIDERATIONS

- Leave the site in no worse condition than existed prior to the investigation;
- Remove wastes that pose an immediate threat to human health or the environment;
- Spread evenly on-site IDW that does not require off-site disposal or above-ground containerization;
- Minimize the quantity of IDW to the extent practicable; and
- Comply with applicable clean-up and disposal standards to the extent practicable and as approved by the KDHE Project Manager.

5. SPECIAL CONSIDERATIONS

Disposal of solids must have concurrence of the KDHE's Bureau of Waste Management (BWM). Responsibility of providing necessary BWM documentation and information is upon the party disposing of the IDW. Waste characterization and disposal must be in accordance with applicable State, Federal, and local waste management regulations and standards.

APPENDIX L

STANDARD OPERATING PROCEDURE BER-12

COLLECTION OF QUALITY CONTROL MEASURES FOR WATER-QUALITY DATA SAMPLES

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-12

COLLECTION OF QUALITY CONTROL MEASURES FOR WATER-QUALITY SAMPLES

Revisor: Farrell Dallen **Date of Revision:** July 31, 2000

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1. PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Documentation of representative water-quality data is essential to hydrogeologic investigations; therefore, the data must be validated though the performance of QC sampling. Verification performance sampling is necessary to evaluate and identify contradictory or suspect data. The QC sampling requirements must be determined by the project manager. If data validation protection is specified as part of the hydrogeologic investigation, QC sampling must be conducted.

The laboratory is responsible for the development and implementation of a laboratory QA/QC program. The collection of field QC samples serves primarily as a check to ensure proper field procedures, but can also serve as a mechanism for the laboratory to perform their QA/QC program (such as collecting sufficient sample for the laboratory to perform matrix spike/matrix spike duplicate samples).

2. QUALITY CONTROL SAMPLES

Samples collected for laboratory analysis require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include duplicate and/or duplicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and field matrix spike. A discussion pertaining to each quality control sample follows:

2.1 Duplicate and Duplicate Split: Duplicate sample analysis is performed to evaluate the reproducibility of collection procedures. A duplicate sample is called a split sample when it is collected with or turned over to a second party (e.g., consulting firm) for an independent analysis or submitted to two laboratories for the same analysis. Duplicate samples are two physical samples collected simultaneously from the same location under identical conditions.

A duplicate sample is collected by distributing water from a bailer, pump, or other sampling device back-and-forth from one sample container to the second sample container until the sample containers are filled. Adequate water should be available to fill the sample containers completely before they are capped. If the water is insufficient to fill all the sample containers at once, then incrementally fill each container with water from two or more bailer volumes, pump cycles, etc, until the containers are sufficiently filled. If collecting volatile organic compound (VOC) samples, the 40 ml vial must be filled completely and sealed immediately prior to filling the second vial to avoid VOC losses. Any deviation from this procedure must be noted, because the laboratory results will not reflect the true VOC value of the sample, if the vial is filled in increments.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be referenced for a description of how duplicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler between filling periods.

2.2 Trip Blank: A trip blank sample is a sample of distilled or de-ionized water prepared in the laboratory prior to sampling, and travels unopened in a common container with the sample bottles. (Note: USEPA uses the phrase "demonstrated analyte free water") It is later opened in the laboratory and analyzed along with field samples for constituent(s) of interest to ascertain whether cross-contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to identify "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest, should accompany each day's samples.

2.3 Field Equipment Blank: A field equipment blank (equipment rinsate) sample is collected to evaluate decontamination procedures. It is a sample of analyte-free media which has been used to rinse reusable sampling equipment and is collected after completion of decontamination and prior to sampling. A rinsate sample would not be collected from a dedicated bailer or a disposable bailer. One equipment blank should be incorporated into the sampling program for each day's collection of samples and analyzed for the appropriate chemicals of concern. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, and auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/de-ionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

2.4 Matrix Spike and Matrix Spike Duplicate: Spikes of compounds (e.g., standard compound, test substance, etc.) are added to samples in the laboratory to determine if the matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection and laboratory spiking and analysis are performed to evaluate the reproducibility of matrix spike results. Additional sample volume may have to be collected for the laboratory to perform matrix spike/matrix spike duplicate samples.

2.5 Field Matrix Spike: A field matrix spike is performed by field personnel prior to delivery to the laboratory and is used to evaluate the test substance's (analyte) stability between spiking and analysis.

A field matrix spike is prepared by filling the sample container(s) to a predetermined volume and adding a known amount of the spike. This procedure must be performed in controlled conditions to ensure that it is completed accurately without any cross contamination of any samples.

The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3. PROCEDURE

(1) Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

(2) Ensure unbiased handling and analysis of duplicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

(3) Verify that each sample container is properly placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° C).

(4) Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, duplicate and blank QC samples will be labeled using codes, and matrix spike and field matrix spike QC samples will be identified as such.

(5) The collection of quality control samples will follow KDHE's SOP BER-01 for the collection of ground water samples.

APPENDIX S

STANDARD OPERATING PROCEDURES BER-019

CHAIN OF CUSTODY

BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION

STANDARD OPERATING PROCEDURE BER-19

CHAIN OF CUSTODY

Revisor: Bill Dodd **Date of Revision:** October 15, 2000

Remedial Section Chief: ____________________ **Date:** __________

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1.0 INTRODUCTION AND OVERVIEW OF CHAIN OF CUSTODY PROCEDURE

Standard Operating Procedure (SOP) BER 19: Chain of Custody documents the protocol used in the transfer of environmental samples to another person or an analytical laboratory. This SOP is intended to facilitate consistency among staff members, serve as a reference and training tool, and provide a formal written record of the method used to transfer custody of a sample in an environmental monitoring program.

Due to the evidentiary nature of samples collected for investigations, the possession of samples must be traceable from the time the samples are collected until they have been introduced as evidence in legal proceedings. After collecting the samples and labeling the appropriate sample containers, all samples shall be maintained under chain of custody procedures. Each person involved with collecting the samples must know chain of custody procedures.

2.0 CHAIN OF CUSTODY PROCEDURES

To maintain and document sample possession, the following chain of custody procedure should be followed.

2.1 CRITERIA FOR SAMPLE CUSTODY

A sample is under custody if:

(A) It is in the sampler's actual possession; or

(B) It is in the sampler's view, after being in his/her physical possession; or

(C) It was in the sampler's physical possession and then he/she locked it up to prevent tampering; or

(D) It is in a designated and identified secured area.

2.2 FIELD CUSTODY CONSIDERATIONS

(A) The number of persons handling the samples should be as few as possible.

(B) The person who collected the samples in the field is responsible for the care and custody of the samples until they have been transferred or properly relinquished.

2.3 TRANSFER OF CUSTODY AND SHIPMENT

(A) Samples must be accompanied by a sample submission form that contains a custody record. Sample submission forms are specific to the laboratory where the samples will be submitted for analysis. Hence, the specified sample submission form for Division of

Health and Environmental Laboratory (DHEL) analysis , KDHE outside contractor laboratory analysis, or in-field analysis should be used. The custody record on the sample submission form documents the transfer of custody for the samples from the person collecting the sample to another person or to a permanent laboratory. In transferring the possession of samples, the person relinquishing the samples and the person receiving them will sign and date the sample submission form.

(B) All packages containing samples should be accompanied with sample submission forms identifying their contents. The original form should accompany the shipment, and a copy should be retained for permanent documentation by the person currently in custody of the samples.

(C) If samples are shipped by a common carrier, a bill of lading should be used. Receipts for bills of lading should be retained for permanent documentation by the person currently in custody of the samples.